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THE SCOTTISH GEOGRAPHICAL MAGAZINE



PUBLISHED BY THE ROYAL SCOTTISH GEOGRAPHICAL SOCIETY
PROFESSOR JAMES GEIKIE, LL.D., D.C.L., F.R.S., HON. EDITOR
MARION I. NEWBIGIN, D.Sc., ACTING EDITOR

VOLUME XXIII: 1907

EDINBURGH

PRINTED BY T. AND A. CONSTABLE, PRINTERS TO HIS MAJESTY
AT THE UNIVERSITY PRESS

1907

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It is provided by Chapter I. § IV. of the *Constitution and Laws* of the Royal Scottish Geographical Society, that—

“The Ordinary Members shall be those who are approved by the Council, and who pay the ordinary annual subscription, or a composition for life-membership.”

The Annual Subscription is One Guinea, and is payable *in advance* at the commencement of each Session. A Member may compound for Life-Membership by payment as follows, viz.:—When under ten years' standing, £20; when over ten and under twenty years, £15; when over twenty and under 30 years, £10; when over thirty years' standing, £5.

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The privileges of Membership include admission (with one Guest) to the Ordinary monthly Meetings of the Society, and the use of the Library and Map-Room. Non-resident Members may borrow books from the Library, but they must defray the cost of transit both ways. Each Member is entitled to receive, free by post, the *Scottish Geographical Magazine*, which is published monthly by the Society.

TEACHER ASSOCIATE MEMBERSHIP.—The Royal Scottish Geographical Society, at a Meeting held in the Society's Rooms on the 8th November 1906, resolved that, with the object of helping to promote the teaching of Geography in Schools, “Teacher Associates” (including Lady Teachers) be admitted to certain privileges of the Society at a reduced Subscription of Half-a-Guinea, payable *in advance* at the commencement of each Session.

The privileges of Associate Membership include *one ticket* of admission (not transferable, and admitting only one) to the Ordinary Meetings of the Society, the use of the Society's Rooms, and the right to borrow *one volume* from the Library. Non-resident Associate Members may borrow books from the Library, but they must defray the cost of transit both ways. Each Associate Member is entitled to receive, free by post, the *Scottish Geographical Magazine*, which is published monthly by the Society.

Branches of the Society have been established in Glasgow, Dundee, and Aberdeen, where periodical Meetings are held.

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THE RIGHT HON. SIR GEORGE TAUBMAN GOLDIE, P.C., K.C.M.G., D.C.L., LL.D.
Gold Medallist of the Royal Scottish Geographical Society.

THE SCOTTISH GEOGRAPHICAL MAGAZINE.

GEOGRAPHICAL IDEALS.¹

By Sir GEORGE TAUBMAN GOLDIE, F.R.S., D.C.L., LL.D.,
President of the Royal Geographical Society.

GEOGRAPHY is an eminently practical branch of knowledge, and it may, perhaps, be contended that it has no place for ideals. There is, indeed, a general aspect of the subject which appeals to the imagination with almost overwhelming force. To explain my meaning, let me first ask and answer the question, What is the *locus* or field of Geography? It is the surface of our globe, in which term we also include the atmosphere and such depths of the lithosphere and hydrosphere as are or have been penetrated or examined by man; so that, to a large extent, it coincides with the *locus* or field of biology, although the contents of the two sciences are, of course, very different. The exactness of my definition may be disputed, but it is sufficiently accurate for my purpose. The entire field of geography is, in any case, only a thin film of air, earth and water rotating and advancing amongst the immensities of the stellar system. But this exiguous film, insignificant in dimensions as compared even with the volume of our small planet, contains all that we know of thought and sensation existing in the universe. Speculate as we may, hope as we may, believe as we may, this minute and whirling field of geography is to us the only place in which, so far as our present knowledge goes, those phenomena exist which differentiate life from inert matter, the only field where the mysteries of reproduction, volition, reason, and imagination have their home.

But apart from this general aspect of an awe-inspiring and yet

¹ An address delivered at the Opening Meeting of the Society in Edinburgh on November 22.

fantastic position, the science of geography is essentially utilitarian. Why then should it need ideals? The answer, to my mind, is that in order to produce the most effective practical work in any department of life, it is necessary to have ideals; even though we can no more hope to attain them absolutely than the asymptote can actually reach the curve which it is ever approaching. Counsels of perfection are, indeed, so often employed as a reason for ill-considered action, or as an excuse for inaction, that it is easy to understand the impatience with which they are generally brushed aside by the practical but not highly imaginative Englishman; but when they are set up only as goals towards which we should struggle, by paths however devious, by successions of compromises, with well-timed haste and with well-timed rest, their value cannot be overestimated. I can think of no finer example of this truth than is to be found in the life of David Livingstone, who was at once an idealist and a practical worker in the highest degree, and who may also be held to have approached as nearly as human nature permits to our conception of an ideal explorer.

Exploration.—I propose to deal, in the first place, with the ideal explorer, partly because of the occasion which brings me here to-night, the award of the Livingstone medal, but mainly because exploration in the present or in the past is the very foundation on which all geography rests. Whether the term exploration be applied to travel amongst barbarous tribes in the heart of an unknown continent, or to the peripatetic examination of some geographical problem in one's own country, the category of the most effective qualities of character and method remains much the same, however different may be the degree in which those qualities are called upon to be displayed.

With an almost unprecedented store of the more passive qualities of physical courage, tact, patience and endurance, which a long life of dangers, obstacles, privations and sickness could not exhaust, Livingstone possessed an equally remarkable store of those more active qualities, which many men have shown for shorter periods, but which few have been able to maintain as he did, during decade after decade, the power of initiative, the almost unerring perception of the most effective ways of attaining his objects with the very limited resources at his disposal, the unwearying persistence in pursuing those objects, and perhaps, above all, the moral courage with which he continually risked one of the most depressing of human calamities, failure. With the exception of physical courage and endurance, the need for which in geographical exploration is rapidly disappearing, these passive and active qualities of character will always remain essential, though in a lesser degree, to the investigator of nature abroad or at home.

As regards Livingstone's qualities of method I would specially deal with his adaptation and cultivation of his mental acquirements for service in every branch of the work which he set himself to perform. Geographers are, perhaps, apt to forget, and missionary societies, at one period of his life, certainly forgot that although Livingstone ranks as the most notable explorer of modern days, taking into account the great number of years over which his services extended, he was (one may say)

born a missionary, he lived a missionary, he died a missionary. He foresaw, when still a youth, that for this work a medical education would be invaluable, a truth which was not so widely appreciated in those days as it is now. The story of his extreme privations and difficulties in obtaining the desired education in surgery and medicine, while barely earning his living in a factory, is at once pathetic and bracing, but my business is only to note that if he had not acquired that knowledge it would not have been a question of his succeeding less completely as an explorer; it would have meant his entire failure at an early stage of his explorations. Of similar character was his thorough acquaintance with the use of tools which he foresaw would be of some value when he became a missionary, and which proved of incalculable value when he, at a later period, superimposed on that calling the career of an explorer. Fortunately also, for general science, Livingstone had, as a boy, taken great interest in botany, geology and zoology, and had devoted his leisure to searches for specimens in the country surrounding his home. At a later period, he cultivated to his utmost power his acquaintance with these branches of knowledge, with the result that the great value of his contributions from Africa was recognised by the most competent authorities. I need only refer to the testimony of no less a person than Professor Owen as regards Livingstone's contributions to zoology and paleontology, to the repeated tribute which Sir Roderick Murchison paid to his services to geology and physical geography, and to the following remark made by the then astronomer-royal at the Cape. "I never knew a man," said Sir Thomas Maclear, "who, knowing scarcely anything of the method of making geographical observations or laying down positions, became so soon an adept, that he could take the complete lunar observation and altitudes for time within fifteen minutes." I quote this verbatim because it shows the intensity and whole-heartedness with which Livingstone threw himself into any new study which his new career demanded, but the need of which he could not foresee until he determined to abandon his South African mission station for exploration in unknown lands.

The special branches of knowledge in which Livingstone trained and perfected himself are not, of course, all needed for explorers in every part of the world, or in every branch of exploration in its widest and truest sense. The explorer who travels round the shores of Britain to examine the conditions of coast erosion will not need for this purpose the particular mental equipment with which Livingstone armed himself, such as medical knowledge, skill in the use of tools, acquaintance with botany and zoology, ability to take accurate astronomical observations; but he will need, as fully as Livingstone needed, whatever special acquirements his object demands, and he will approach the ideal explorer in exact proportion to his previous cultivation of the necessary technical knowledge and powers of scientific observation, and to the character which he displays in the pursuit of his labours. Tact, persistence and moral courage are hardly less essential to genuine success in civilised lands than they are in barbarous regions, and it is indeed an open question whether African chiefs, in the days of their independence, were not,

as a rule, less unsatisfactory to deal with than the governments of our own and neighbouring countries.

Cartography.—Upon the foundation of exploration, in its wider meaning, geography constructs its basement of cartography on which must rest the entire superstructure of the science, so that our next question concerns the ideals towards which cartographers should advance. Many years ago the late Elisée Reclus, perhaps the greatest geographer of the generation now passing away, strongly advocated before the Royal Geographical Society a method which must, I fear, long remain only an ideal, namely the use of relief globes, or sections of globes, of such dimensions—say on the scale of 1 to 100,000—that even heights of 150 feet would be distinctly shown, without adopting the usual method in relief maps of exaggerating the proportional height of hills and mountains. On globes of such dimensions the geological and ecological features of the surface could also be displayed in considerable detail. After quoting the view urged many years ago by a scientist, whom he justly termed “one of our eminent geographers, Dr. H. R. Mill,” that “accurate cartographic representation is the very essence of geography,” Elisée Reclus proceeded to point out that “there is only one way to represent truly the surface of the earth. Curves are to be translated in curves. . . . Therefore are we really astonished that public attention and the special care of geographers are so little attracted towards this logical mode of geographical work.” He noted that globes of considerable dimensions—up to the scale of one millionth—had indeed been made for exhibition purposes, but that these had “made no pretence to accuracy in geography proper.” He might have added that, on so small a scale, such globes would have been useless for effective hypsometrical representation as regards regions where the elevations were generally less than 3000 feet, so that while Scotland would display some of her beautiful hypsometrical features, England would show a somewhat plain face. It will not be denied that there is immense force in Elisée Reclus’s proposals. Under the existing system of education boys are taught to think of the earth’s surface only in terms of plane trigonometry; and although this method is approximately accurate over small areas, it is absolutely misleading when the areas are large, the globes in ordinary use being so small as to make it difficult for a boy to co-ordinate them in thought with the flat maps presented to him of individual countries. Moreover, it is one of the important advantages of real geographical study, as it is of the study of astronomy, that the mind is trained to think in terms of both spherical and plane trigonometry; and this double standpoint gives the student that stereoscopic view of nature which is essential in every department of thought, if existence is to be appreciated as a solid reality instead of as a flat and unsubstantial picture. The more effective qualities of the average officer of the navy or the mercantile marine (as compared with the average landsman of equal general education) are everywhere recognised, and are, doubtless, due to several concurrent causes; but it does not seem to me far-fetched to attribute them in some part to his studies in navigation which necessitate his acquisition of the habit of viewing

space from a double standpoint. In elucidation of my meaning I would recall a remark made to me many years ago by a great philologist that when a man for the first time studies another language than his own, he acquires ideas on language generally which would otherwise have always remained unknown, and even inconceivable to him. One of our leading statesmen invented the happy phrase "Learn to think imperially." I would say to the young geographer, learn to think spherically.

Before leaving Elisée Reclus's proposals for exhibiting the earth's surface on curves and in relief with the same scale for plan and elevations, I feel compelled to protest, of course with the greatest deference, against the unmitigated scorn and condemnation which he and some other eminent geographers have heaped upon the usual system of relief maps or globes which exaggerate the proportional height of hills. Until we reach Reclus's ideal of globes or sections of sufficient dimensions to depict the true hypsometrical proportions, and until such globes or sections can be so multiplied as to be within reach of every school throughout the civilised world, it is difficult to see how an average boy is to acquire, without the aid of the ordinary relief map, an initial grasp of the morphology of an extensive region. No doubt the use of the ordinary relief map must be accompanied by careful explanation of the difference of the vertical and horizontal scales; but it does not require much imagination in the student to make the necessary mental adjustments. Those of you who have, when bicycling or motoring, used a guide-book giving profiles of the roads with a vertical scale several times as large as the horizontal scale, will, I feel sure, confirm this view. My protest arises from personal experience. It was not until at the age of nineteen I visited Switzerland and Germany, which, even at that date, possessed excellent relief maps, with of course exaggerated heights, that morphology became a reality to me; and there must be millions who, like myself, have not been gifted with an innate initial power of full realisation from representation by projection, where perspective cannot be called in to assist. Once the sentiment of reality is fully established by the aid of relief representations of a region over which one moves, flat projections become for ever as communicative as they are to those more fortunate persons who are born cartographers.

For the present, Reclus's gigantic globes or sections of globes are not available and we must do the best that we can to improve our flat maps. The ideal flat map would include every datum with which the science of Geography in its most advanced state would deal. It would represent all the great physical features of the earth's surface, land and water in all their various forms, mountains and hills, valleys, plains, plateaus and depressions, oceans, inland seas, lakes and rivers. It would show both the hypsometrical features of the lithosphere and the bathymetrical features of the hydrosphere. It would indicate in a general way the surface geology. It would mark the average rainfall and prevailing temperature. It would show the main economic or ecological characteristics of regions represented on a small scale, and would deal in detail, on a large scale, with regions calling for special attention; while in wholly undeveloped parts of the world, the characteristics of the

surface would be exhibited, such as forest, prairie or other grass lands, desert and swamp. It would indicate the distribution of life in its various forms, showing the leading features of vegetable life, and the principal types of wild animals, where such existed. So far, however, the ideal map would exhibit only the framework in which humanity is set, the theatre on which man has to play his part. To make it complete, it must show the distribution of various types of mankind over the face of the earth, the boundaries of states, the density of population, and to some extent the general results of man's interference with natural conditions, or what is generally regarded as political and economic geography. I do not pretend to have exhausted all that it should exhibit. I have only pointed out leading features that it should not omit; and I may sum up by saying that the ideal map of a region should contain in cartographical symbols all the information which would be necessary to a student who wished to write a complete geographical memoir of the region; for cartography is the basis of all sound geography. Such a map is at present only an ideal which should be striven after by all conscientious and competent cartographers, as far as is now practicable. The question of the best methods and symbols to be employed must be left for discussion by cartographical experts, who appear, however, to have widely differing views on the subject; but criticism is permissible to those who have not constructive or creative genius, and I may point out one method which is clearly unscientific. One has seen maps issued from time to time under the title of commercial maps, and professing to show the distribution of products and industries, in which the names of these seemed as if they had been distributed over the sheet by means of a pepper box. Horses, silk, cattle, iron, sheep, grass, pigs, wheat, wine, and scores of other names were scattered in a haphazard fashion, which not only failed to inform, but actually misled any one unacquainted with the regions represented.

One of the most difficult tasks for the cartographer seems to be an adequate representation of the hypsometrical features of the earth's surface. For certain purposes the contour map is very useful, especially if, as in the Swedish Official Survey map, each contour is shaded with a gradually intensified tint of brown from the sea-level upwards. A very effective method of contouring is that which Japan adopted some twenty years ago, and which is now used in the United States Geological and Geographical Survey. This consists of lines in a tint of brown so arranged that at a slight distance it produces the effect of excellent hill shading: while, on close inspection, one is able to read the contours. Perhaps, however, the best result is produced when really good hill shading is used in combination with contours, as is the case with the Swiss Survey maps. This method shows very clearly the lie of the land, while one can also read the contours from the lowest level to the highest. Another very good example of this method is the map of Tunis, on a scale of 1 to 50,000, which has been recently published by the French Intelligence Department. I feel that it might be invidious to mention by name any particular cartographical establishment in these islands, or even on the continent of Europe, but I have little

doubt that most of you have already made up your minds as to which, on the whole, are the most useful as well as the most artistic Atlases available in the United Kingdom. My chief fear is that the majority of the general public who have not yet been reached by the geographical training so rapidly spreading on improved lines all over the country, may form their estimate of atlases on their cheapness or on their quantity and not their quality, or on the number of names which are to be found in their indexes. Other things being equal and subject to there being no sacrifice of clearness, a large number of names is an advantage, but if they are divorced from their natural physical and economic setting they convey very little real information. I hope that the time has passed when it was thought that any production was good enough for a school map or a school atlas, and that we are alive to the obvious fact that the maps on which children are trained have no less importance than those which are for the use of adults. It may not perhaps be practicable to produce an atlas in which all the maps are on the same scale, but some confusion in juvenile minds might perhaps be avoided if the maps were all on a multiple or a measure of a standard scale. It will, I think, be generally agreed that there is room to-day for even a better atlas than any now existing, and we can only hope that with the spread of geographical education the necessary encouragement may be given to publishers to expend the large amounts which the production of a first-class atlas would undoubtedly require.

Geography in War and Peace.—To whatever point of excellence cartography may be brought, however, it can never be more than a means to an end, excepting to a small number of artistic minds to whom a really fine map is a thing of beauty and a joy for ever. The same principle applies to geographical knowledge generally, which may be its own reward to a few detached minds, but which will be estimated by most men at its practical value to mankind. A few words must therefore be said as to their most important uses in war and peace, and we may possibly find some ideals at which we should aim in these directions. I put war first as the primitive state of mankind and not yet entirely out of date. It is a moot question whether war is more useful to geography or geography to war. The proposition that war has been one of the greatest geographers has been so frequently expounded at length and is so obvious to the student of history that I need not dwell upon it in this brief address, only remarking that it is interesting to find the conviction of its truth existing even in the United States where, more than in any other great country, the development of geographical knowledge and peaceful expansion have gone hand in hand.

During the Spanish-American War a well-known scientific authority, Professor Chamberlin of Chicago, pointed out that the war might be expected to produce a great revival of interest in geography throughout the United States. He concluded: "It was observed at the close of the Civil War that those who returned from its campaigns possessed an appreciation of the elements of position and physical relationship quite beyond that realised by the preceding generation educated under the benign influences of peace."

We now know that Professor Chamberlin's forecast was correct, the Spanish-American War having given an undoubted acceleration to the progress of the geographical spirit in the United States similar to that which he tells us was observed after the Civil War.

The value of geography in war, on the other hand, may perhaps be best brought home to our own countrymen by recalling the enormous expenditure in which the want both of maps and of geographical training of our officers indirectly involved us during the Boer War. I can speak confidently on these points from having served (for nearly a year) on the Royal Commission on the South African War. It is a matter of deep regret that, during the many years of peace and colonial expansion at the close of the last century, Great Britain did not expend a moderate sum annually in mapping the unsurveyed portions of the Empire. We should not then have found ourselves attempting to relieve Ladysmith or advancing to the Modder River without maps of the country. It is only fair to add that the lesson of the war, in this respect, has not been altogether forgotten. During the last four years a certain amount of money has been expended in imperial mapping of hitherto unsurveyed regions; and if this process is not altogether arrested by a spirit of false economy, we may possibly at some distant date possess fairly adequate maps of all British possessions. That is at any rate an ideal which we should strive to attain. As regards the want of geographical training of our officers, I have not time to cite the mass of evidence given before our Commission by the most competent authorities as to the general deficiency in knowledge of ground, than which, as Lord Roberts and others pointed out, nothing could be more important in war. Even as regards staff officers, who have considerably more training in this subject than the ordinary regimental officers, Lord Roberts was often struck with their inability to read maps well or to explain quickly and intelligently about the contours and elevations. In this respect our ideal should be to reach the level attained by Japanese and German officers.

Geographical ignorance is a costly luxury in times of war, but it is perhaps still more costly in times of peace. No estimate, even of the roughest kind, can be formed of the vast sums that have been wasted in modern days through States collectively, on the one hand, and individual settlers, on the other hand, attempting to produce grapes from thorns and figs from thistles.

This subject of the practical uses of ecology, or economic geography, is far too large to be treated here incidentally; it would require an address or rather a series of addresses to itself. A mass of literature on the subject already exists; but this will probably be read only by specialists, or by those who can give a good deal of their time to scientific geography. For others, the best short manual on the general question is still, to my mind, that entitled *Applied Geography*, by Dr. Scott Keltie, who is recognised, both at home and abroad, as one of the most capable and best informed geographers of this or any other country. I understand that he is a Scotsman; and as I am speaking to a Scottish audience, I may briefly refer to the splendid ecological

work that Scotland has done in the exploration, settling and development of those vast regions known as the Dominion of Canada, which have before them so assured and so great a future. The part that Scotland has played in that work up to 1882 is, I think, best told in Mr. Rattray's *The Scot in British North America*, which many of you will have read. I may say that it was lent to me by a very distinguished Scot, whom the rising generation probably know chiefly as the Lord Strathcona, who raised and equipped Strathcona's horse during the Boer War, but whom older geographers remember as the Donald Smith who played so important a part in the development of the North-West regions. I need hardly remind you that from Canada comes another Scot—Sir John Murray—who is, admittedly, the greatest oceanographer and limnologist that the world has produced; that the most successful settlement in South Africa was the Scotch settlement in Cape Colony; that Natal is a second Scotland; that the acquisition of British rights in East Africa, which promises to show important ecological results, was due to the efforts of the late Sir William Mackinnon, and was largely the result of the explorations of Joseph Thomson; that the province known by the misleading name of British Central Africa was opened up to commerce by the Scottish African Lakes Company, and was made into a peaceful British possession by the first recipient of your Livingstone Medal, Sir Harry Johnston; or that, a century ago, the marvellous travels of Mungo Park were the genesis of the entire movement which has opened up Africa to civilisation. It must, I think, be admitted that Scotland was in the forefront of the great geographical and imperial movement of the nineteenth century. Nor has she neglected the more purely scientific sides of geography, as was evidenced by the recent successful national expedition to the Antarctic regions; while her cartography, as represented by Keith Johnston and Bartholomew, has undoubtedly led the way in these islands. I trust that this vigorous and practical geographical spirit may long endure and, if possible, increase. Although the era of exploration, in the conventional sense, is drawing to a close, there is an unlimited field open for scientific exploration and economic treatment. Mankind has hitherto dealt with the surface of Mother earth in a haphazard, a hand-to-mouth fashion, without much scientific study of the varying ecological conditions in different localities, due to the various combinations of slightly differing climates, soils and other geographical data. Is it an unattainable ideal that scientific changes in the distribution and methods of production may some day raise humanity, so far as material comfort is concerned, as much above its existing standard as this is above the material condition of the ill-clothed, ill-sheltered, ill-fed denizens of these islands at the commencement of our present era?

Education.—Whatever may be the proper aims of geography as a science of the utmost value, both in war and in peace, sound and extensive geographical education is an essential condition of advance towards those aims, and the question at once confronts us as to what should be our educational ideals. You will remember that, after the Household Suffrage Act, Robert Lowe gave the celebrated advice, often attri-

buted to Lord Beaconsfield, "Let us educate our masters." By our masters Mr. Lowe meant of course the masses, and the nation have had the question of the education of the masses with them for a whole generation; while—at any rate south of the Tweed—they seem likely to have it with them for some generations to come; but I venture to repeat here, what I have often urged elsewhere, that on many subjects, of which geography is one, we need in the first place to educate the classes. This may not be an unattainable ideal, though it is still distant.

In an address which I delivered at York last August before the British Association I pointed out the advance during the last quarter of a century in the interest in and appreciation of geography displayed by the governing classes. A case of atavism, recently brought to my notice, makes me fear that I was too sanguine as to the permanence of that advance, at any rate in one important quarter.

In November 1899, regulations were laid down for the examinations for the Foreign Office and Diplomatic Service, which naturally (and I believe merely in repetition of earlier regulations) made geography an obligatory subject. A notice has lately been issued, to come into effect after the 1st July next, under which geography will not only not be obligatory, but will altogether cease to be one of the subjects of examination. I have not time to give you a list of the many other subjects for which marks will be given to candidates, and which do not seem to be as important as geography to a Foreign Office clerk or to a Secretary of an Embassy. I will only select six rather striking examples: Animal Physiology, Physics, Chemistry, Moral and Metaphysical Philosophy, Sanskrit Language and Literature, and Zoology, which, of course, may be useful if the official spends his leave in a country where big game is plentiful. In these six subjects the candidate might make 3600 marks out of the maximum of 6000, which he is not allowed to exceed; while not a single mark is given for Geography. One is reminded of Mr. W. S. Gilbert's "Pattern of a modern Major-General," in "The Pirates of Penzance," who was an adept in every branch of human knowledge, excepting tactics and strategy.

The urgency of the case impels me to narrate an interesting incident not yet published, especially as the principal actors in the scene are dead, so that no one's feelings will be hurt by the narration. A good many years ago a territorial arrangement with France was in discussion, and I was invited to consider it. The French proposals appeared to the Foreign Office satisfactory; but I found that they were expressed, as might have been expected, in longitudes reckoned from the meridian of Paris, while the map with which our Foreign Office had considered these proposals was made in Germany and reckoned its longitudes from the meridian of Greenwich. The arrangement in question was never completed.

This was an instance which came under my personal observation, but it is a matter of notoriety that some of our most serious international disputes of recent years have arisen from the faulty geographical knowledge of the negotiators of treaties in the darker ages. I believe

that our Foreign Office and Diplomatic Service for years past have been filled with men of considerable geographical knowledge; but this improved condition will not last if geography is to be eliminated from their examinations, and Great Britain will see its future diplomatists contending with bows and arrows against foreign diplomatists armed with the best weapons of the twentieth century. The most serious feature of the case, however, is that such an official denial of the national importance of geographical education is to-day possible. It shows the immense obstacles that still confront our Geographical Societies before they can make great and lasting advance in what seems to me one of their most urgent duties, that of educating the classes of Britain.

Turning from this fundamental postulate to the general principles underlying a sound geographical education, I should like to put before you the substance of a most interesting letter on the subject which I have recently received from Mr. H. J. Mackinder, Director of the London School of Economics, and whom you know to be one of the highest authorities in Britain on Geographical Education. I have only time to read extracts; so that you will not hold the writer too closely to passages given without their context. He says, "Geography must not be thought of as a mass of information merely, or indeed chiefly. Its distinguishing characteristic, giving it peculiar value as a discipline, is that it has its own special point of view and mode of thought and of memory. The geographer thinks in spaces and shapes. So far from names being material to the subject, even words are not essential to geographical thought. . . . In the elementary stage the teaching of geography should not adhere pedantically to any method. The main point is that a few things should be vividly and rationally taught. Such precision as is involved in the use of latitudes and longitudes should be eschewed, unless in the highest standards. No doubt nature-study should come first, but it must not be substituted for geography, for which it only prepares. . . . In secondary education the teaching of geography should, I think, be more methodical and precise, but what is chiefly important is that it should be progressive in method. Geography may well serve in this stage for the purpose of correlating subjects, both scientific and historical, but the more that such a function is assigned to it the more necessary does it become to have a clearly defined and strictly geographical argument running through the whole of the teaching. In other words, the geographical point of view must be dominant, and not the view points of this or that auxiliary science. . . . In the University stage, geography should be studied both from a specialist and from a general standpoint; that is to say, that while it is a condition of progress in our knowledge that we forsake the whole field and concentrate on some part of it, yet it is only in the university stage that what I may describe as the philosophy of the subject can be fully appreciated. It is essential, however, that the specialist should already have firmly acquired the geographical method and the geographical point of view. Until secondary education in geography is more generally thorough, I fear that the University teacher of the subject will have to teach much which in a future generation will have been learned by his

pupils before they come to him. To my mind, by far the most important function of the University teacher of geography in the present and immediate future must be to produce a considerable number of good secondary teachers of the subject, and to establish a tradition of geographical school teaching. The danger of the moment is that in view of the sudden demand for school teachers of geography which has recently sprung up, we shall be tempted to equip and employ persons of inferior general education and mental power. Geography requires in the teacher both a firm grasp of principle and a broad outlook. With these qualities, I believe that it can be made a discipline of the highest order, but no subject is so easily reduced by an inferior teacher to a low pedagogic value, worthy of all the contempt that has been poured upon it."

Although Mr. Mackinder's remarks in this letter proceed from elementary teaching upward to the University, we know that he is in full accord with the policy followed by the Royal Geographical Society during the last twenty years, of regarding recognition of geography at our great Universities as the first and most important step in impregnating the country with a geographical spirit, and of working downward from there into the masses of the nation. As I dwelt on this question at length in my York address, I will only add that it now seems certain that the Welsh University will shortly have a Reader in Geography, and that I cannot doubt that Scotland will succeed in her present efforts to endow a Chair of Geography at the University of Edinburgh, which has, I understand, done all in its power to facilitate such a measure. It would, indeed, be extraordinary if this country, which, as I have just shown, has been in the forefront of the great geographical movement of the last century, should allow herself to be permanently distanced in this one direction—admittedly of the highest importance—not only by Oxford, Cambridge, and London, but also by Manchester, Birmingham, and gallant little Wales.

Amongst the minor methods of arousing interest and imparting information in geographical matters, perhaps the most effective is the comparatively modern use of photographic lantern slides. For either purpose the value of accurate and artistic visual representation accompanying aural explanations can hardly be overestimated, whether the spectators and audience are trained geographers or elementary school children. Even so lately as thirty years ago geographical lectures were generally dreary affairs—except for the enthusiastic few—unrelieved, as they were, by pictorial representations. I feel very keenly the disadvantage I am under, or rather that you are under to-night, through my having no slides; but there was no remedy; for although photographs have, I am told, been taken of ghosts, no one has yet attempted to photograph an ideal. When we consider the instruction of children the necessity becomes still more evident of interesting the eye as well as the ear; and I hope that this principle will be more and more understood in our board schools, in most of which the study of geography now consists of learning strings of names. The method of visual representation has, indeed, spread greatly during the last decade; but it does not

yet cover a tenth of the field that it might usefully occupy. I believe this is partly due to the cost and difficulty of getting good slides, and I may be doing a service to some who wish to interest and instruct their fellow-parishioners in the country by drawing their attention to the series of the Diagram Company, whose address is West Barnes Lane, New Malden, Surrey. I could not, of course, mention this Company if they had been formed for purposes of profit. I am told, however, that their objects were scientific, and that they do not at present cover their expenses. Many of you, doubtless, know their excellent slides. We have a complete series in Savile Row, and I understood that one was also kept at the Outlook Tower in this city; but Professor Geddes tells me that this is not now the case.

Another minor educational ideal is that all books involving movement from one geographical locality to another should have sketch maps attached to them. This principle applies especially to works of fiction, which reach a far wider public than is the case with serious books. When we re-read the Waverley Novels after reaching maturity, and with a knowledge of the positions and surroundings of the localities dealt with, we cannot avoid regret that our childish interest in each of them was not quickened and our knowledge insensibly increased by a simple sketch map on the frontispiece. This stimulating power of pictorial representation is perhaps most clearly demonstrated by a case in which the map was as imaginary as the text. How much of the interest of *Treasure Island* would have been lost but for the immortal map with which Robert Louis Stevenson enriched it! Stevenson, indeed, was deeply imbued with the geographical spirit, and in several books—I can particularly recall *Kidnapped*—produced real maps which greatly assist the young reader. Half a century ago, even history—ancient, mediæval and modern—was read in the best schools without any reference to maps, with the result that most of us had to endure the loss of time in re-reading, when grown up, a mass of works which we had literally, but not geographically, mastered in our youth.

I have reserved to the last the few words I need say on the most vital and far-reaching of all instruments of geographical education—I mean societies such as this. They have afforded means of higher and ever-extending knowledge even to the most instructed of their Fellows; they have encouraged the geographical spirit amongst their less zealous members; they have been the chief authors or supporters of all other modern means of improvement in geographical education; while the rôle that lies before them is even more important than that which they have hitherto filled. That is why I am here to-night; and if I might add one more ideal to my list of geographical ideals, it is that every educated man in Scotland should join your Society, and, by his contributions to your funds, enable you to extend and intensify your work in promoting a branch of knowledge which is one of the most important, if not the most important, of the material sciences to the future welfare and progress of mankind.

GEOGRAPHICAL PHOTOGRAPHY.¹*(With Illustrations.)*

By JOHN THOMSON.

MY chief object in coming before this Section is to show on the screen a selection of geographical photographs taken by myself during my travels, which extended at intervals over a period of forty-five years. The major part of the work was done in Far Eastern Asia, between 1860 and 1872, in regions in which the camera frequently made its first appearance. Some plates were taken later to illustrate my work on the island of Cyprus, others I have borrowed of recent date produced by modern methods.

Before using the lantern, I will give a brief summary of photographic progress, mainly in its bearing upon geographical work. In the early days, about half a century ago, the enormous weight of dark tent, instruments, and chemicals, combined with the technical difficulties of primitive processes, rendered a photographic equipment a very doubtful addition to the burden of the explorer bent on a long journey into unknown or unphotographed lands. It was an experiment not to be lightly undertaken, and in my experience meant the addition of four or five carriers for safe transit.

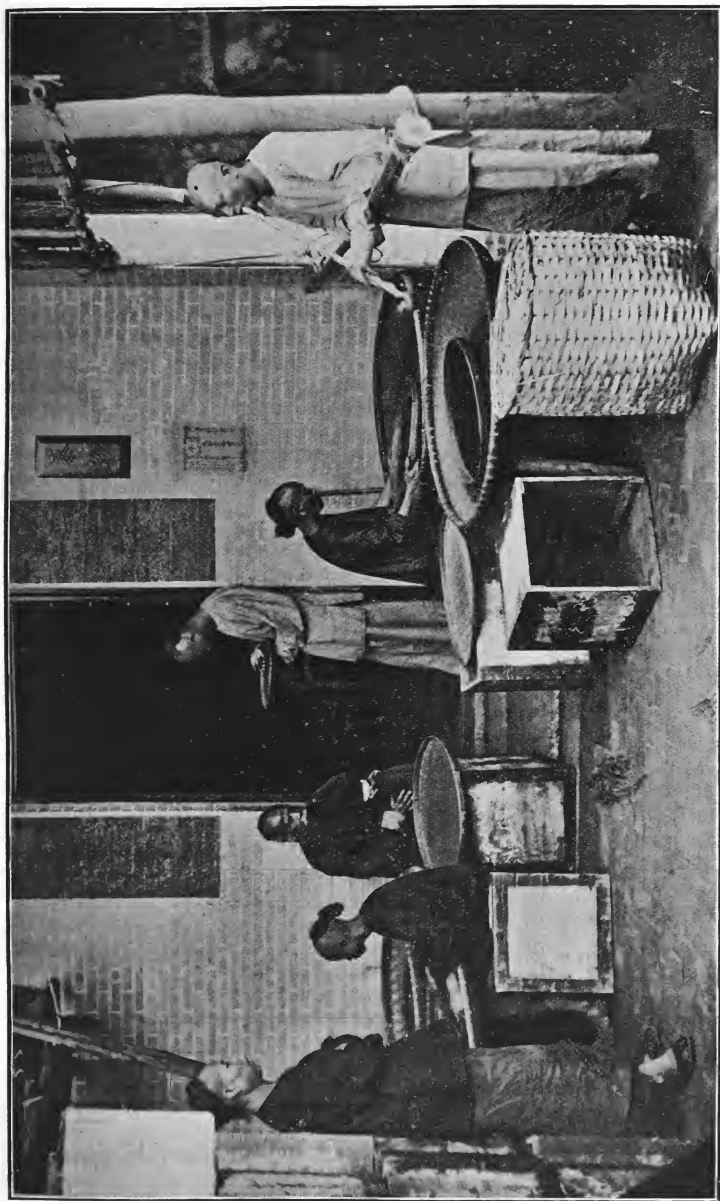
But happily the rapid advance in photography gradually reduced the bulk of impedimenta; apparatus became lighter, and manipulation simpler and more certain in result, until an outfit was deemed indispensable to all properly organised expeditions.

The evolution of photographic methods kept pace with the progress in discovery in almost all departments of Science, and contributed its full share of usefulness in extending knowledge and solving problems that without its aid would have remained insoluble. In Physical Geography it has proved of notable service, especially in helping the work of the cartographer. It has made us familiar with the topography of remote quarters of the globe, and with the physical characteristics of their people, environment, dwellings, tillage, arts, industries, etc.

I will now touch upon some points in the progress of the art which ultimately fitted photography for its vocation as an auxiliary in scientific research and artistic pursuits.

In its initial stages it was regarded as a curious and fascinating revelation of the action of light on certain chemical re-agents, that is up to the time of Daguerre and Fox Talbot; the former caught the image as in a mirror, the latter, the Caxton of Photography, produced the first printing process by his introduction of Calotype in 1839. Later, when pursuing his investigations with bitumen-coated metal plates, he succeeded in etching the first photogravure, and printing from it in an ordinary press. He was also first to foresee the potentialities of the

¹ Read before Section G (Geography) at the York Meeting of the British Association.



Interior of a Chinese Tea Hong.

new art in relation to Geography. I have a map etched on a metal plate about this time by Fox Talbot, and printed in Edinburgh, first copying the original in the camera. After the lapse of some years full of endeavour on the part of photographic votaries, who from time to time scored advances, Scott Archer gave us his wet collodion process, which materially shortened the duration of exposure necessary to obtain an impression in the camera, and substituted glass plates as the support for the sensitive film. The detail in wet collodion negatives was of microscopic minuteness while presenting the finest gradation and printing quality, which had never indeed been surpassed by any known method. Improvements in cameras and lenses had been going on apace, the first gaining in lightness and portability, while plano-convex and miniscus lenses had given place to compound objectives, corrected for spherical and chromatic aberration, and thus rendering their visual and actenic foci coincident. The wet collodion process, appropriately so named, could not shed its ponderosity, and was hedged round with difficulties, as I had reason to know and appreciate, and ill adapted for long journeys. It was the most chemically and mechanically exacting companion to be carried on any expedition, and its shortcomings were accentuated when my wanderings happened to be through forest and tropical jungle. One special virtue must be noted, and that is that the plate had to be exposed, developed and finished on the spot, so that one was enabled to judge of success or failure before striking camp.

You will be able to form your estimate of the work done under more favourable conditions than I enjoyed in doing it, and I must request you to bear in mind difficulties that had to be faced day by day, in repairing apparatus, concocting and doctoring chemicals, not to mention dangers encountered from unsympathetic natives, who regarded the photographer as the devil incarnate, and allow some critical discount in my favour.

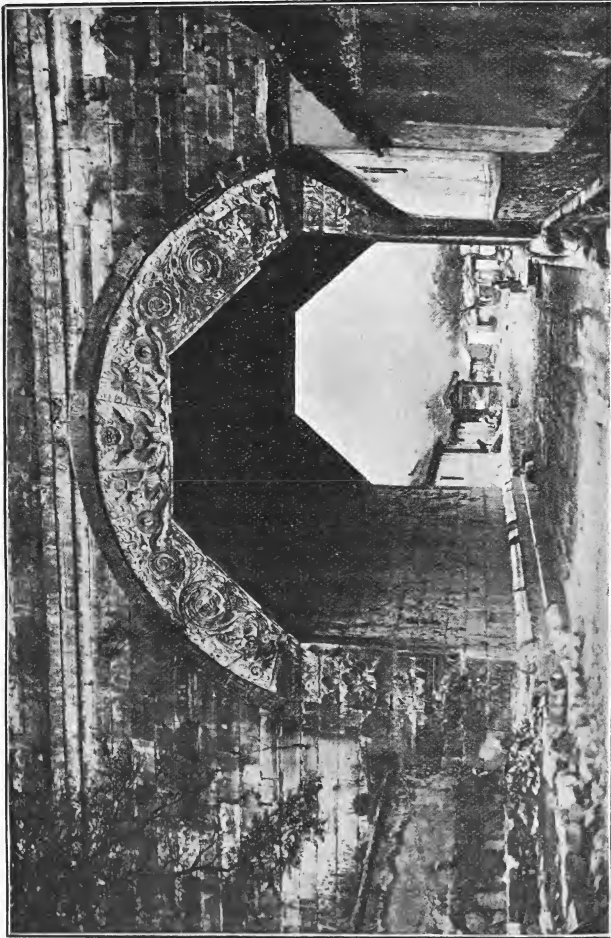
Dry collodion emulsion, introduced in 1864 by Messrs Sayce and Bolton, greatly reduced the weight of essentials. I employed plates coated with this emulsion later in Cyprus. They were developed with an alkaline solution, and were in no way inferior in point of speed or quality.

Gelatine emulsion, made by Dr. Naddox in 1872, was the crowning discovery which entirely revolutionised photography, rendering it possible to photograph objects in motion in the fraction of a second. I had the pleasure of making the acquaintance of the inventor a year or two before his death—one of the most thorough, simple and unaffected of men. The cameras in use for dry gelatine plates and films are so multiform that they may not even be catalogued. For our purpose it is sufficient to say that an outfit for a long journey may now be carried in a handbag.

The ever-widening sphere of usefulness of the camera as an auxiliary in scientific investigation, especially in relation to Geography, is so well known that I will only venture to note some recent developments which may prove useful to the traveller.

An ordinary well-made camera fitted with shutter and rapid recti-

linear lens is most useful in securing photographs of all objects which may not be carried away. But for anthropological work, as, for example, in taking plates of characteristic heads of alien races of men at close



Ancient Arch at Kew-yung-kwan, Nankow Pass.

quarters, the lens should be longer in focus than that used for landscapes or groups. The reason of this is that with a lens of short focus the features are so distorted as to render the photograph useless as a basis of measurement. The defects could only be partially rectified by

mathematical calculation on the basis of the focus of the lens employed and distance from the object photographed.

In dealing with objects of natural history, such as animals at a great distance in their native haunts, an addition to the same camera must be made in the shape of a tele-photographic set of lenses, so as to photograph objects on a scale large enough for subsequent use. The same tele-photographic arrangement may be used for a variety of purposes, as in taking contours of distant mountain ranges. These are set down simply as suggestive notes in camera-work which the traveller who is thoroughly acquainted with the use and limitations of the instrument may extend at will. Many failures are caused by neglect on the explorers' part to get fully posted up in the mechanism of the camera and shutter, the use of the lens, and the chemicals employed in fixing the image, and in development. I have in my mind the poor results of some long and arduous journeys brought about by ignorance of the elementary conditions of success—plates decomposed, stuck together, damp, frilled, fogged, over-exposed, under-exposed, developer wrong; result no image, fixed before being developed, etc., etc. But by a little trouble and preliminary training all such pitfalls might have been avoided and success assured.

The seeming simplicity of photographic work has been a prolific cause of failure—the notion that one has only to touch a button to obtain the best results possible.

A word on photographic surveying. It is described in *Hints to Travellers*, published by the Royal Geographical Society.

The apparatus in use is too complicated, and I believe the conditions required could be attained by the adjustment of an ordinary camera. It should be framed so as to admit of the optical axis being perfectly horizontal and the prepared plate at right angles to the axis. Two photographs must be taken at points of view some distance from each other to give a base-line, and from these the cartographer can set down the relative positions of objects shown in the photographs by triangulation.

The late Dr. Schlichter in 1893 described a means of finding the latitude by lunar observations taken in the camera when a star appeared sufficiently near the lunar disc as to come about the centre of the field. Several exposures were made on the same plate at properly measured intervals of time, these by micrometric measurement forming the basis for calculation. The result was an extremely accurate determination of longitude.

I have been frequently asked if photography in colours as it now stands may be relied upon to give absolute mimicry of natural objects.

There is no process by which a photograph in the colour of the object photographed may be directly taken in the camera. There are methods in use by which fascinating results are obtained by taking a set of colour registers through three as nearly as possible monochromatic glass screens or filters—red, blue, and yellowish green; this is termed three-colour photography. The negative so taken may be used either for what is called optical synthesis by projection through three

colour filters by a triunal lantern, or by reflection and combination in an instrument called the Kromoscope. When properly registered the result is an image in all the colours of the object photographed. Mr. Mackinder was the first English traveller to test this process in his visit to Mount Kenia. The negatives again may be printed on transparent gelatine tissues stained and superposed, as in the Sanger-Shepherd method, or used to make half-tone blocks to be printed in three colours in the printing press.

THE DEAD HEART OF AUSTRALIA: A REVIEW.¹

THE scientific expedition which is the subject-matter of the exceedingly interesting work now before us, took place in the summer, *i.e.* the Australian summer, of 1901-2, and from the preface we learn that the narrative has for the most part already appeared in a Melbourne newspaper. Dr. Gregory, the head of the expedition, is now Professor of Geology in the University of Glasgow, and he had as his colleagues a party of eight, most of whom were undergraduates of the University of Melbourne. It appears that it was at the suggestion of Dr. Howitt that the expedition was undertaken with the view of studying the geology of Lake Eyre, the Dead Heart of Australia, and of making a collection of its fossil bones. Professor Gregory, the geologist, hoped to help Dr. Howitt, the ethnologist and student of the Australian aborigines, "by explaining some of their traditions, by throwing light on their migrations, and by showing the date of their arrival in Australia." But before referring to the route and progress of the expedition, it is right to give to our readers some information about Lake Eyre and its vicinity. The tract of Australia, which bears so ominous a name, is one of the most remarkable among the many remarkable regions in the island continent. It is situated to the north of Spencer Gulf and has an area of over three thousand square miles. Its surface is 39 feet below the level of the sea. The lake is fed by several rivers and creeks on all sides, but its principal contributors are the Diamantina and Cooper rivers, which flow into it from the east for some months each year. It also receives the drainage water of half a million square miles and absorbs it all. The lake may be said to have been discovered in the year 1840 by E. J. Eyre, an Australian cattle-driver, who, however, was also an explorer in the true sense of the word. The story of the discovery and of the angry controversies of the time is succinctly and graphically told by Dr. Gregory. So far as the topography of Lake Eyre is concerned, the whole locality was carefully surveyed some thirty years ago. It is indeed terribly true that now the tract fully merits the name of the Dead Heart of Australia, but once on a time the name

¹ *The Dead Heart of Australia: A Journey round Lake Eyre in the Summer of 1901-1902, with some account of the Lake Eyre Basin and the Flowing Wells of Central Australia.* By J. W. Gregory, F.R.S., D.Sc. London: John Murray, 1906.

of Living Heart would have been much more appropriate; and this for several reasons. "It gives its name to the largest of the three provinces into which Australia has been divided on biological evidence: for it is the typical district of the 'Eremian' region proposed by the late Professor Tate, from the evidence of plant distribution; and it suggested the name of the 'Eyrean Province' proposed by Professor Spencer, in considering the distribution of Australian animals. Anthropologically Lake Eyre is important, as it was the headquarters of the natives of the two-class marriage group, who advanced thence south-westward to the Eyre Peninsula and spread south-eastward until they peopled Western Victoria." But unhappily, owing to a deficient rainfall, the climatic condition of Lake Eyre changed, and it is no longer an active and creative centre. "The lake has no outlet, and none of the water it receives is passed on to areas that would make better use of it. Animals and plants are continually emigrating into the Lake Eyre basin from the surrounding highlands; but these reinforcements are insufficient to make good the internal waste. Great hordes of rabbits invade it, only to perish when the plains are stricken with drought. Mobs of cattle are driven on to its pastures, too often to die, overwhelmed by dust-storms or miserably bogged in the mud of the drying waterholes. The insatiable desert now produces little new; its plants and animals are few in number and in kind, and they are stunted in their individual growth." At one time, according to Dr. Gregory, the area of the lake was three times as large as it is now; great kangaroos and wombats as well as wallabies, bandicoots, and marsupial rats inhabited its shores, and crocodiles and huge mudfish its waters. "But the rainfall dwindled, the water-level sank, and the lake decreased in size. The discharge from the lake was no longer sufficient to keep open its channel, which the warping of the surface and the accumulation of debris continually tended to close. Accordingly Lake Eyre lost its outlet; its waters were henceforth removed only by evaporation; the salts, carried into the lake by the rivers, were concentrated, until the waters became salt and the fish and the crocodiles were all destroyed. As the lake shrank in area, less and less rain fell upon its shores; the vegetation withered; the once green, succulent herbage was replaced by dry, spiny plants; the giant marsupials died of hunger and thirst; hot winds swept across the dusty plains, and the once fertile basin of Lake Eyre was blasted into desert." When did this drying up take place? Dr. Gregory replies that it began early in the Pleistocene age. But the detailed evidence in support of this theory was too technical for the present work, and will doubtless be set forth in a future volume, where it will receive the attention to which it is unquestionably entitled.

It was no holiday task then which Dr. Gregory and his associates had undertaken. The traditions of the Lake Eyre district are evil, and there was no doubt about the fact that the expedition had chosen a time of the year when the heat was at its worst. One old explorer wrote to the papers stating that to go to Lake Eyre at that time of the year was little short of madness. Meteorological statistics showed that the temperature of the previous year had at one place varied between 118° and

125° in the shade. Undeterred, however, by considerations of personal danger, the members of the expedition left Adelaide on the 13th December 1901, and after a two days' journey by rail they reached Hergott, some 440 miles from Adelaide, where they met their camels and their camp equipage, and where they got the first taste of the heat they were to endure. They had reached Hergott at the end of a heat wave and found the heat intense. It, however, seems to have no deleterious effects on the white population, the men of which were found, bronzed and tanned, in the best of health, "working in the open air at severe manual labour without adopting any precautions or special clothes." On this subject Dr. Gregory has some interesting remarks, viz.: "The tolerance of heat shown in this part of Australia certainly supports Sambon's theory with regard to acclimatisation. Sambon holds that there is nothing to prevent Europeans living and working, as well as any black race, in the hottest of tropical localities. He maintains that the supposed unsuitability of the tropics for European settlement is due to disease and not to climate, and that as the special tropical diseases are due to germs, they may be cured or prevented when the life-histories of the germs are known. The sight of white men engaged in severe manual labour, under the midday sun in the hot climate of the Lake Eyre depression, certainly suggested that a 'White Australia' is no impossible ideal for even the hottest regions of the centre."

Notwithstanding his having received much advice to the contrary, Dr. Gregory had decided that the means of transport for the expedition should be camels, and on the whole he had no reason to regret his decision. He found that "they carried their 6-cwt. loads with ease, except occasionally over bad sand-rises; they ate any food that came in their way, or fasted like philosophers when there was none. . . . They soon went for a couple of days without water, and, later on, would abstain for several days without suffering." From Hergott Springs the expedition proceeded north-eastwards to the missionary station of Kilalpanina, where they arrived in time for the Christmas festivities, celebrated by the Lutheran fathers in the German fashion so far as was practicable, and varied by corroborees performed by the junior members of the expedition to the undisguised amusement of the aborigines whom they found there. From Kilalpanina Dr. Gregory made a short expedition to another mission station, Kopperamanna, in order to examine the country by which the Cooper river passes through the Desert Sandstone hills. He found that within a few miles of Kilalpanina the Cooper had no definite bed, but was a flood plain some eight to twelve miles in width with sharply defined flood-lines contracting to the east. Continuing his investigation east of the mission station, Dr. Gregory went as far as a knoll, from which he could see the main channel of the Cooper pass north of a ridge bearing an ominous name in the vernacular, signifying "the place of death and destruction." From what he saw where he stood on the knoll he was able to form an opinion as to the origin of the famous Stony Desert, which Sturt had described as an ancient seabed. Contravening this, Dr. Gregory tells us that the pebbles of the

stony plains show no signs of the action of water. "The Stony Desert, in fact, is due to the absence of water. The country where it occurs was once covered by a sheet of the rock known as Desert Sandstone, in which there are abundant pebbles of quartz, sandstone, and other hard materials. The Desert Sandstone has slowly decayed under the action of the weather; the loose sand has been blown away by the wind, and the hard fragments remain scattered over the ground. The Desert Sandstone once spread in a continuous sheet all across the Lake Eyre plains; and wherever the waste from the Desert Sandstone has not been covered by later deposits, it litters the ground as the barren Stony Desert." Having satisfied himself on these points, Dr. Gregory returned to Kilalpanina, rejoined his companions and started westwards down the Cooper for Lake Eyre. In a few days they found quantities of stone flakes, which had been used by the aborigines as knives and scrapers, and in the bed of the Cooper they found fossil bones of kangaroo, bandicoot, crocodile, mudfish, and birds. On reaching the shores of the lake it was found to be practically dry, and as no fossils could be obtained, the party returned up the Cooper to the base camp at the waterhole at Markoni. Anticipating favourable weather, Dr. Gregory decided to march northwards across the fifty miles of Tirari desert to the Diamantina river, where he expected to find a sufficient supply of water. On the 11th January 1902, having given the camels a good drink and carefully filled the water-casks and bags, the party made a start on a most dreary expanse of sand-dunes, *i.e.* ridges of loam with a thin crust of white sand on each slope. Recalling one part of this journey, Dr. Gregory says, "I often loitered behind the caravans to get a wider view across the country. The soil was bare, the grass-tufts withered, and the scenery seen from the dune-crest was undeniably depressing, and the whole land looked dead. The few black stunted trees, with their gnarled trunks and leafless or needle-leaved boughs, had an appropriate resemblance to dead funereal cypress. The sides of the dune were covered by long wavy sand-ripples, where the wind had driven the grains up the western slope; but at the same time not a sand grain was moving, and the ripples looked as motionless as the fossil ripple-marks that may be seen on some London paving-stones. The air was still and heavy—there was not a sound; and the only visible sign of life and motion was the steady drift of the useless clouds across the leaden sky. Earth and sky seemed to be outlying each other in repellent monotony. The earth was repulsive in its arid, forlorn barrenness, and the sky was still more repulsive in its sunless pall of cloud."

On reaching the station of Kalamurina the expedition were disappointed to find it had been deserted, but a good supply of fresh water was found in a pool of the bed of the Diamantina, and the general appearance of the country indicated that there need be no fear of a failure of water. A second disappointment at Kalamurina was that no fossil remains could be found there owing to a flood up the river, which some months before had covered them with silt. As a recompense, however, Dr Gregory found it "the best zoological and botanical collecting ground

we had yet visited," and accordingly a halt was made there for some days, which Dr. Gregory utilised in making an expedition up the valley of the Diamantina to the east for the purpose of studying the geology of the tract. He was fortunate also in finding some interesting fossils. Had there been abundance of time a much longer period could have been spent very profitably at Kalamurina and its vicinity, but the train to Hergott, which it was imperative the expedition should catch, ran only *once a fortnight*, and so it was necessary to proceed onwards without further delay. They followed the course of the Diamantina westwards for fifty miles, of which Dr. Gregory writes: "The scenery was full of variety and often beautiful. The river passed below cliffs of marl, crowded with large gypsum crystals, whose faces flashed in the sunlight like plates of silver. Elsewhere the river channel was bounded by high bluffs of bedded loam; and from their summits we enjoyed fine views of long serpentine reaches of salt water, entrenched in the broad river-bed. Additional interest was given to these salt-pools by the swarms of birds that frequented them—swans, shags, pelicans, goliath-parrots, and sea-gulls." At the end of the fifty miles they reached Poonaranni, the last outpost of the stations along the Queensland Road on the eastern side of Lake Eyre; and from there they had to make their way along the northern side of the lake through country of which very little was known, till they reached the stations along the Overland Route on the west of the lake. In the course of this march they had to cross the Kallakoopah and Makumba rivers. Had they been able to procure local guides from among the few aborigines whom they met, their difficulties would have been much lessened, but unfortunately, on the one occasion when they found some of the natives, the blacks fled away in dismay when the white men appeared. The difficulties, however, of the region which had to be travelled over, turned out to be not so formidable as was anticipated; and when, about half-way across, the party had the good fortune to pick up a native who was a friend of one of their guides, they soon reached Peak station on the west of the lake, where they arrived just in time to witness part of a corroboree, a very interesting description of which is given in another part of the book. From Peak station a night march took them to Warrina, where they caught the fortnightly train to Adelaide and brought to a conclusion a very arduous and successful expedition. The publication in detail of the scientific results will be awaited with much interest.

In this volume Dr. Gregory discusses with much acumen and conspicuous impartiality several questions, the interest and importance of which are not confined to Australia. For example, in the course of his travels he came across a good number of aborigines of various tribes, and evidently spared no trouble in studying and investigating their origin, condition, and capacities. He formed on the whole a kindly and favourable opinion of them, a few words of which may be quoted. "Instead of finding them degraded, lazy, selfish, savage, they were courteous and intelligent, generous even to the point of imprudence, and phenomenally honest; while in the field they proved to be born naturalists and superb bushmen. . . . Before our stay at Kilalpanina

had come to an end, we all shared the feeling, that of all the quaint delusions concerning Australia, the quaintest is that which represents its aborigines as the most useless and untrainable of savages." In another passage he refers to their affection for their children and care for the aged and infirm members of the tribe, and to their unusual receptivity of education. With regard to the vexed question of their antiquity, he impugns the theories of Barton and Dr. Lang, and on a careful consideration of their skulls and physical features, and still more of their type of mind, he has come to the conclusion that the aborigines of Australia belong to the Caucasian section of the human race.

It was inevitable that in a work on the "Dead Heart of Australia" Dr. Gregory should have much to say about its climatic conditions and water-supply; and indeed the last quarter of this book is devoted to this subject, the interest and importance of which to Australia are very obvious. It was only in the year 1880 that the existence of an Artesian supply of water was discovered and realised, and now Artesian wells are fairly numerous, especially in Queensland, but they have not been nearly so successful or profitable as was anticipated. For this there are two causes: the one, the excessive soakage and evaporation, which account for a very large proportion of the water which reaches the surface; the other, the highly saline quality of the water in many places, which tends in a comparatively short time to destroy the fertility of the soil. Thus it comes about that the principal use of the Artesian wells is merely to provide water for cattle on the stock routes through deserts. But of late years the Artesian theory has been much discredited and is now fast giving way to the Plutonic theory, which is based on the distribution of the water, the variations and pulsations of its pressure, and its chemical qualities. We must refer our readers who are interested in this subject to the lucid and thoughtful exposition of it which they will find in this book. Dr. Gregory gives good reasons for believing that the supply of subterranean water is limited, and that the unnecessary waste of it which is now going on is in the last degree impolitic and should be prohibited by legislation. In his last chapter he discusses the proposal to flood Lake Eyre from the sea, a fascinating but impracticable idea which took shape in 1883, some six years after the fantastic proposal to flood the Sahara of Africa from the Mediterranean. The idea to flood Lake Eyre was revived about a dozen years ago, and rough estimates of its initial cost were prepared. They amounted to the prohibitive sum of £740,000,000, to which had to be added an enormous sum for cost of maintenance. It was also calculated that in thirty years, owing to evaporation, which goes on at the rate of 100 inches per annum, the whole bed of the lake would be filled with salt. The project was accordingly abandoned, probably for ever.

But it is impossible, within the limits of our space, to give even a summary of the information Dr. Gregory has collected and laid before his readers on these and other highly important topics, or the reasoning for the conclusions at which he has arrived. We have, however, said enough to recommend this very interesting work to our readers. We must add that the author's style, even when dealing with scientific matters,

is crisp and lucid, bright and often humorous—the style of a master of his subject, who writes with all the confidence and clearness gained by experience and conscientious study, and thus commands and receives the sustained and interested attention of his readers. The photographs which illustrate the work are good, and there are also a couple of maps which contribute materially to the convenience of the reader.

THE VOLCANOES OF MEXICO.

1. AMONG the papers of which advance copies were distributed to the members of the International Geological Congress in Mexico is one by Mr. J. G. Aguilera (Director of the Mexican Geological Institute), entitled “Les Volcans du Mexique dans leurs relations avec le relief et la tectonique générale du pays.” It is accompanied by a map, on the scale of $\frac{1}{5,000,000}$ or 78·9 miles to 1 inch, on which all the volcanoes known to him are shown (so far as the scale permits). There is a curious omission on the map, viz. the volcano of Tuxtla, SE. of Vera Cruz, although it is thrice mentioned in the text. The map also shows the chief faults, lines of fracture, and lines of plication of the strata, and is accompanied by a corresponding map on tracing paper showing the position and direction of the mountain chains and the distribution of earthquakes.

The author points out that the volcanic rocks occur chiefly in the western half of the country, and are only sporadic in the east, except in the region where the states of Vera Cruz, Puebla, and Hidalgo meet. The volcanic rocks belong principally to three types—andesites, rhyolites, and basalts. Generally speaking, the andesites were extruded first, then the rhyolites, and lastly the basalts, though there are exceptions to this order. The andesites were usually erupted through vents (“cheminées”), hence by crater eruptions, although fissure eruptions are not rare. The rhyolites, on the contrary, were the result of fissure eruptions, with the exception of the Pico de Bernal, NE. of Queretaro, and one or two others in the state of Queretaro. The basalts were almost exclusively the product of crater eruptions.

Vulcanism, which probably began to manifest itself in the Eocene, has continued to the present day with generally decreasing energy. Contrary to the common idea that the Mexican volcanoes are near the sea, almost all of them are in reality very far from it. The coastal volcanoes are few, namely, those of Mexican Lower California, of Tepic territory, Ometepe in the state of Guerrero, Tuxtla in the state of Vera Cruz, and one or two others.

The Mexican volcanic arc is parallel to the Western Sierra Madre, and the volcanoes are more numerous on the eastern side of that range, that is, towards the Central Plateau; they are also irregularly distributed over the plateau, and are few in number in the Eastern Sierra Madre, such as occur there being almost all on its side turned towards the plateau (except Tuxtla).

There are two predominant directions of faults, fractures, and folds in

Mexico; firstly, from NW. to SE., and secondly, from NE. to SW.: the latter is less constant than the former. A third less frequent direction is east and west. The volcanic manifestations have taken place in lines parallel to the mountain folds. The mineral veins, which owe their origin to the volcanic rocks, exhibit very constantly a parallelism to the lines of relief.

Mr. Aguilera claims to have demonstrated¹ that the volcanic fissure of Humboldt,² which Felix and Lenk also suppose to be a transverse fracture situated on the southern margin of the Central Plateau (Mesa Central), the border itself being a manifestation of the fissure, does not really exist, and that the valley of the Rio de las Balsas is a valley of erosion posterior in date of formation to the volcanoes of the Central Plateau.

The seismic zones of Mexico are not situated in the volcanic zones, but on the contrary they occur in regions where there are no volcanoes. The seismic area is situated in the most ancient part of the country where one might have expected great stability; it is in the region of Archæan rocks.

2. *The Volcano of Nauhcampatepetl or Cofre de Perote.*—In the *Boletín de la Sociedad Geológica Mexicana*, tomo i. (1904), pp. 151 to 168, is a paper in Spanish, by Mr. Ezequiel Ordóñez, entitled “El Nauhcampatepetl ó Cofre de Perote,” in which the extinct volcano situated N. lat. $19^{\circ} 29'$ and W. long. $97^{\circ} 12'$ is described, with four views. It owes its names, Cofre de Perote and Nauhcampatepetl (from Mexican *Nauhcampa*, four-sided; *tepetl*, mountain) to the coffer-like vestige of a lava bed, in the form of a flattened rectangular prism, with an estimated length of 300 metres, a height of 25 metres at its eastern, and 40 metres at its western end, which forms its summit. Its altitude is 4282 metres (14,048 ft), though the Mesa Central at its western foot reaches 2400 metres (7874 ft.). The summit does not reach the snowline, but the limit of arborescent vegetation on the western side is at 3850 metres (12,628 ft.). The mountain consists of numerous superposed massive beds of lava, inclined in the same direction as the slope of the mountain sides and separated by beds of agglomerate, or by brecciform rocks, indicating that the heated overlying lava-stream produced a re-fusion in the underlying already cold bed; in other cases the lava beds appear to be fused with one another. Some half-melted lava masses were, however, ejected by

¹ Aguilera, “Sobre las condiciones técnicas de la República Mexicana,” in the *Anuario de la Acad. Mex. de Ciencias Exactas, Físicas y Naturales*, vol. iv. pp. 103-104 (1900). I have not seen this paper. Dr. Emilio Böse, chief geologist of the Mexican Geological Institute, maintains the same view in the chapter “On the Origin of the Mexican Mesa Central,” in Bulletin No. 13 of that Institute, entitled *Geología de los Alrededores de Orizaba* (1899). He says (translation), p. 49, “The Mesa Central of Mexico is a completely secondary phenomenon and is not to be attributed to great lateral fractures (it is not a ‘Horst’ [area left above its surroundings by circumjacent depression]), but was formed by the filling up of the most elevated valleys of the ancient mountain mass by masses of eruptive rocks, volcanic sands and modern alluvia.”

² See *Cosmos*, Bohn’s edition, 1849, vol. i. p. 238, where Humboldt states that Orizaba, Popocatepetl, Jorullo, and Colima “are situated in a transverse fissure running from sea to sea.”

small apertures on the flanks of the great cone forming small conical domes near the "llano de los Pozitos" at 3000 metres. The lava streams succeeded one another with such rapidity that it would be impossible to establish any chronological distinction between them. They appear to belong to a single period of eruption. One's chief preoccupation on arriving at the summit of Nauhcampatepetl is to discover the vent from which so enormous a mass of lavas has been extruded, since no complete crater exists, and in this respect, and in the mode of occurrence of the lavas, the mountain greatly resembles Ixtaccihuatl. Between the summit proper and a peak which Ordóñez terms Pico de Mitancingo, hardly 500 metres distant and of almost the same height, is a deep cavity open to the east in the form of an inverted half-cone, called the Potrero de las Viboras. While the lavas of the summit are slightly inclined to the west, those surrounding the Potrero have a contrary inclination. Hence Ordóñez is inclined to regard the Potrero as the place of exit of the lavas, although for such a vent it is very narrow. The general impression that one obtains on visiting the volcano is that of a mountain in ruins. The lavas are hypersthene andesites,¹ the porphyritic constituents being labradorite, andesine, hypersthene, and augite, and the ground-mass consisting of more or less devitrified glass with microlites of oligoclase, augite and black iron ore.

After a long period of repose volcanic activity was resumed, not by the ancient vent, probably closed for ever, but at numerous points on the eastern side of the mountain, and more basic basaltic lavas were poured out from numerous well-formed scoria cones.

Ordóñez holds that the great volcanoes of Mexico, in spite of their size and altitude, are the results of the localisation and subdivision (owing to the consumption of material and energy) of a great internal reservoir of magma, which began to reach the surface at the beginning of the Miocene. As a proof of this, he mentions that certain Mexican volcanic sierras are formed in great part of one single type of eruptive material without sudden changes of composition. These homogeneous sierras do not exhibit a structure indicating a formation or growth due to successive accumulations of lava, but were formed at one eruption; they are elongated as if they had been formed along fissures. On the flanks and extremities of these masses we meet with monogenic volcanoes, composed of successive beds of lava, volcanoes of suddenly arrested activity, to which type he refers Cofre de Perote. Lastly, we have the great cones, also built up of beds of lava, but in which the diminished volcanic activity manifested itself for a long time intermittently and with a great number of explosive eruptions, during which the old lava fields and the extensive lakes of the neighbouring valleys were covered with thick beds of volcanic dust and pumice. The volcanoes of the second type exhibit summits of crestlike form, as two examples of which we have Nauhcampatepetl and Ixtaccihuatl, each of them contiguous to a magnificent cone of the third type, namely the Peak of Orizaba (Citlaltepetl) and Popocatepetl.

BERNARD HOBSON.

¹ In Professor J. C. Russell's *Volcanoes of North America* (1897), p. 186, they are called dioritic trachytes.

WESTERN TIBET AND THE BRITISH BORDERLAND.¹

THE title of this book inverts the order of the contents. What is called "The British Borderland" naturally comes first, and Tibet across its border follows. The author is the Deputy Commissioner, or chief civil officer, of the British Hill District of Kumaon, and the book is the result of a journey made by him and Dr. Longstaff from Almora, the district capital, along the eastern frontier of the district by the Kali Valley and over the Lipu Lekh Pass into the adjacent parts of Tibet. The return into Kumaon was made over the passes on the western frontier of the district which lead into the Milam Valley.

Kumaon, with the contiguous district of British Garhwal on the west, was ceded to the British in 1816 after the Gurkha War. It has thus been under British administration for ninety years, and is a district well known to and much visited by British residents in Northern India. It has also been the subject of many official reports. To this day the most notable of these are the reports of its first British administrator, Mr. G. W. Traill, of the Bengal Civil Service. They were written in 1823 and 1825, and were republished with Government sanction by the Asiatic Society of Bengal in volumes xvi. and xvii. of *The Asiatic Researches*. They are the basis or contain the gist of most of what has since been recorded officially or otherwise regarding Kumaon. But it has remained to the author of the book before us to describe parts of the district in a popular way, filling in many interesting details, and above all to put his contribution into a pleasing (if *weighty*) form by means of an almost innumerable collection of beautiful photographs.

The orographical features of Kumaon and Garhwal, as of other parts of the Himalayan region, are striking. The districts in rough outline make up a parallelogram about one hundred and twenty miles in length and one hundred in depth, abutting on the east upon Nepal, and facing to the south-west the alluvial plains of the Gangetic valley, which at the base of the mountains may be said to have an average elevation of about twelve hundred feet above the sea-level, and to the north-east the plains of south-western Tibet, the average elevation of which may be put at 14,000 feet. The ranges by which the districts are traversed trend mainly from north-west to south-east, as do the ranges that run through the Tibetan plateau. The main axis or watershed lies to the north close to the southern border of the Tibetan plateau. Along the watershed, and connected with it by spurs projecting mostly to the south, are the snowy ranges ("The Snows") of this part of the Himalayas, knotted here and there into groups

¹ *Western Tibet and the British Borderland, the Sacred Country of Hindus and Buddhists, with an Account of the Government, Religion, and Customs of its Peoples.* By Charles A. Sherring, M.A., F.R.G.S. With a chapter by T. G. Longstaff, M.B., F.R.G.S., describing an attempt to climb Gurla Mandhata. With Illustrations and Maps. London: Edward Arnold, 1906. Price 21s. net.

of peaks, over 20,000 feet, some of which are among the highest, and present scenery of snow-field and precipice as grand as any in the world. It is this lofty region, with the valleys, having an elevation ranging from 10,000 to 14,000 feet, that are enfolded in it, that is "The Borderland" of this book. It is called Bhothe by the people of Kumaon, and its inhabitants are Bhotias. The ranges which traverse the middle and southern parts of Kumaon are much lower, averaging in height from 5000 to 9000 feet; and they are, except during short periods in the winter, snowless.

The streams which pass down the larger valleys between the ranges throughout Kumaon-Garhwal mostly issue from glaciers in the snowy ranges. A number of these glaciers are of great size, and they descend to 12,000 or 13,000 feet above the sea-level and about 3000 feet below the permanent snow-line. The streams are shed off in channels of steep gradient, at first mostly towards the south-east or south-west, till they turn the flanks of the ranges through deep and precipitous gorges, the first excavation of which is possibly as old or older than the beginning of the elevation of the folds of slowly rising land out of which the ridges themselves took form. Their rapidly flowing waters then find their way southward into the Indian plains. None of these streams, not even the headwaters of the great Ganges itself, have their sources to the north of the Kumaon-Garhwal watershed. In this respect they differ from the Indus and Sutlej to the west, and the Kurnáli and a few other of the great eastern affluents of the Ganges, as well as the great Brahmaputra, to the east. The Kumaon valleys lying south of the snowy ranges are for the most part narrow and deep, with precipitous forest-clad sides rising abruptly from the level of the river-bed, especially on the northern sides which face southwards. Those within the snowy ranges, after being entered from the southward through steep and difficult passes, are found sometimes to open out into wide treeless stretches of pasture land with comparatively easy gradients overtopped by bare scree and crag; while the slopes on the northern side of the watershed gradually fall away in expanding and comparatively short valleys into the Tibetan plateau. The region south of the snowy ranges is one drenched by the periodical rains of India, and cut back by the channels of violently rushing rivers and streams of high incline. That within and beyond them is sheltered from violent and excessive rainfall, and no part of it lies at an altitude very much below the sources of its streams. Therein lie the chief immediate factors in the evolution of their present physiographical condition.

The part of Tibet's vast area which lies to the north of the Kumaon mountains is its south-western corner, called by the inhabitants Nari Khorsum, and known to the people on the British side of the frontier as Hundes. Its extent may be put at from 20,000 to 25,000 square miles. It has been more or less visited by Europeans since early in last century; and a good deal of information about its physiography and people has been collected by various travellers, and gathered from British Hill subjects trading with its inhabitants. An account of the adventurous journey of Moorcroft and Hearsey in 1812 (before Kumaon

or any other Hill district had come into British hands) was published in 1816; and an account, well worthy of being put on record, more especially for its scientific value, of a journey made in 1848 by Sir Richard Strachey and Mr. J. E. Winterbottom, has in recent years been printed in volume xv. of the *Geographical Journal* of London. The journey was one of three journeys into Tibet during 1846-49, in which Sir R. Strachey or his brother, Henry Strachey, took part. And in 1866-68 extensive explorations were made by Pandit Nain Singh of the Indian Survey, who penetrated to the gold diggings of Thok Jalung on the north-west confines of Nari. But it has to be noted that, with the exception of that of Moorcroft and Hearsey, the visits of travellers and sportsmen to Nari were made by stealth, or in defiance of the local Tibetan officials; and therefore at some disadvantage for purposes of inquiry and observation. The outstanding feature of the Tibetan journey described in this book is that it was made openly, presumably with the sanction and support of the Indian Government, and with the consent of the Tibetan officials, lay and ecclesiastical. The author visited the headquarters of the Tibetan officials, which are also the trading marts, from Taklakote below the Lipu Lekh Pass to Gartok in the west, and was permitted to enter and inspect the monasteries and temples on the route. The latter, no European, as far as is known, had ever before entered or even approached. If therefore the author has not as an original explorer added to our knowledge of the general geography of Nari, he has been able to verify and fill in much detail, and to illustrate his narrative and observations with a great wealth of admirable and apposite pictures. After all, the main objects of his journey were not so much geographical, as the initiation of friendly and confidential relations with the Tibetans and of commercial and other communications between India and Nari. In this object, by his tact and kindly bearing, he seems to have been very successful.

The physical features of Nari are as uniform as those of Kumaon are varied. It is as a whole a stone-covered, wind-swept, nearly rainless plateau, lying about 14,000 feet above the sea-level. Along the rivers whence irrigation is possible the soil is under cultivation; elsewhere the land is only capable of supporting the flocks and herds of the scanty nomads. Mineral wealth, including gold, it possesses. But borax and salt are the only such products which have in the recent past been to any extent material of foreign commerce. The gold has always gone to Lhasa and Pekin.

Nari is intersected from north-west to south-east by hill-ranges at an elevation of 2000 or 3000 feet above the plain. In, or as off-sets, of these ranges there arise in some places groups of massive peaks reaching 3000 or 4000 feet more. Such are Kailas and Gurla Mandhata, an account of Dr. Longstaff's plucky attempt to scale the latter of which forms one of the chapters of this book. They are situated on the eastern limit of Nari, and are part of the watershed on the eastern side of which rise the headwaters of the Brahmaputra, and on the southern and western those of the Kurnáli, the Sutlej, and the southern branch of the upper Indus. In themselves, as compared with the Himalayan snowy groups, Kailas and

Gurla, with the Rakshas and Mansaróvar Lakes at their foot, seem to present no very special features of mysterious grandeur or beauty. Their place in Hindu and Buddhist myth and theogony is possibly due to their position, hid away from the known world of Hindustan and the Panjab, behind the all but impenetrable barrier of the Himalayas, on the confines of an unknown and ghostly country. It may be doubted whether to the Hindu of to-day they, as places of pilgrimage, very strongly appeal. For they have no Hindu shrines, and passing beyond Kelarnath and Badrinath in the Garhwal mountains, shrines at which priests summoned from Southern India minister, the pilgrim enters a foreign and inhospitable land which now knows not (if it ever did) Shiva and Vishnu, and where none of their votaries are present to receive and apply votive offerings and call forth the rapture of the worshipper. Comparatively few, therefore, of the hill-going pilgrims pass into these higher regions, and it is questionable whether, even with an open and safe Tibet, the throng will ever be great. In its religious aspect as affecting India the author seems, in a word, to over-estimate the importance of Nari.

Who were the earliest human occupants of the Kumaon Hills has not been proved. Possibly survivals of them may be seen in the Rajis or Rawuts (the Forest-men) living near Askot, and in the servile Doms or Dumras to be found throughout Kumaon south of the watershed. These are not Aryan by race; nor, apparently, are they mongoloid, of the type found in Bhote. Their affinities may possibly be found to be with some of the so-called aboriginal tribes of north-eastern India, whence, in that case, they entered the hills. Superimposed upon this lower stratum of population, except in Bhote, is the great body of Hindus known in Kumaon as Khasias. They are divided into various castes and have various traditions as to the places of their origin. They speak and write a dialect of the Hindi language, and their general social economy is that of the Aryan peoples of the plains of north-western India. Their ostensible religion also is the ordinary Brahminical cult of the Indian continent, inwoven here as there into a texture of local spirit and ancestor-worship, which in reality dominates their lives far more than the priestly cult does. Among them are scattered families of bluer blood, the descendants or survivals of high-caste families who, probably more recently than the Khasias, came from the Indian plains and gained predominance, general or local, over the hill-dwellers. For instance, a dynasty of Surajbans (solar) Rajputs known as the Katur, is said to have once ruled Kumaon; and within recent historic times the Raja of Kumaon was a Chandarbans (lunar) Rajput, whose remote ancestors were said to have lived in the Gangetic Doab. The Rajbar of Askot spoken of in this book is also a Surajbans, and socially superior to the surrounding Khasian Hindus.

It is wholly different with the upper stratum of population in Bhote. That seems to be mongoloid and to have entered its present seats from the north. As a fact Bhote was formerly part of the kingdom of Tibet and was conquered by the Rajas of Kumaon and Garhwal well within historic times. The north-eastern corner was perhaps never fully

subject to the Hindus of Kumaon, and was only incorporated in that principality when in 1791 A.D. it was overrun by the Gurkhas, by whom it was ceded to the British twenty-five years later. To this day (or at any rate till quite recently) the Bhotias, although British subjects dwelling in British territory, continue to acknowledge Tibetan suzerainty by the payment of certain taxes, the enforcement of which is secured by their trading interests in Tibet.

How closely the Bhotias are akin by descent to the existing tribes of Nari is not clear. The dialects spoken by them are apparently related to those used there. But socially and religiously the Bhotias are far parted from the Tibetans. While the latter are Lamaists and Shamanists, overridden by priests and wizards, and cursed with the custom of polyandry, the former are not. Their ancestral customs and beliefs, some of which are minutely described in this book, have probably been best preserved by the eastern clans. These exhibit a social condition which, if not highly moral, is yet singularly free from the demands and restrictions that burden and repress the Hindu, and from the abject submission to priestcraft and demonology that prevails in Nari. They worship they know not what at little rude shrines adorned with prayer flags; and the essence of their religion seems to be the fear and appeasement of countless spirits and phantoms, including the spirits of their ancestors. But between the worshipper and the Unseen no professional human intermediary is employed; and ghosts notwithstanding, they are a light-hearted and cheerful people, as well as industrious and energetic. It is truly remarkable that this small body of eastern Bhotias should have preserved, as they have done, their primitive customs and traditional beliefs alike against Hindu and Buddhist.

The case of the western Bhotias is otherwise. They afford another instance of what has frequently been observed in India, namely the gradual absorption of non-Aryan tribes into the ranks of Brahmanism (see Sir Alfred Lyall's *Asiatic Studies*, 1st series, chapter v.). Why the Bhotias remained outside Buddhism when their neighbours and rulers in Nari became Buddhists, and the influences of Brahmanism have been more potent in western than in eastern Bhote, is not fully apparent. Doubtless the western Bhotias have been associated with Hindus during the last two hundred years or longer, more closely than their eastern brethren; they are certainly nearer to the great places and routes of Hill pilgrimage. They are now, in fact, a more civilised and polished community than the eastern Bhotias. From among them have sprung two at least of the best of the Indian Government's native explorers and surveyors—Nain Singh ("A") and Kishna Singh ("A. K."), both of whom are natives of Milam. The opportunities of these men have been exceptional. But they are samples of the mental and moral capacity to be found in the remote Bhotia glens.

The energy of the Bhotias find their exercise in trade. The practical monopoly of the traffic across the Kumaon and Garhwal passes is in Bhotian hands, under strictly regulated arrangements among

themselves and their Tibetan correspondents. It is carried on by packs upon the backs of sheep, goats, and cross and thoroughbred yaks, by which are transported the grain, sugar, cloths, and hardware (exports from India), and the salt, borax, and wool (imports into India), which form its staples. The value of the exports and imports is comparatively small, and is not likely, for a long time to come, to become very great. But the trade is worthy of encouragement as giving employment to the labour and capital of a sturdy and enterprising, as well as loyal, race of traders and carriers, who are capable also of becoming one of the vehicles of British influence in Tibet.

The kinship of the people of Nari to the mongoloid races of Central Asia seems to lie rather in the direction of Burma and south-western China than on the other hand northwards in the direction of Tartary and Mongolia. It is known, too, that between India and Tibet, including Nari, there was considerable communication in past ages; and whatever may have been the case with Tantrism, Buddhism entered Tibet from India. The primitive cult of the country was no doubt demonology, in contact with which the imported Buddhism probably degenerated more and more from the original Indian doctrine and practice. It seems unlikely that much early intercourse between India and Nari took place over the Kumaon and Garhwal passes. It was carried on chiefly from the west along the valleys of the Indus and the Sutlej, a line of access which the Mongol invasion of Mirza Haidar in the sixteenth century and the Sikh expedition of 1841 showed to be practicable. But for a long period under the Lhasa Government Nari has been a closed country against India. That the people themselves have no antagonism or aversion to the foreigner from the south is plainly seen from this book; and official obstruction having been removed, development of intercourse with India, to the advantage of the people of Nari as well as of our own traders, becomes possible and likely. Rude and barbarous as they are, the people seem to be characterised by certain robust and improvable qualities. Their country is, however, limited in resources and thinly populated; and they are ruled by an unenlightened and greedy hierocracy and officialdom. A great and rapid improvement in the condition and affairs, commercial or other, of Nari cannot reasonably be looked for. Yet such expeditions as that of which this book contains the record cannot fail to accomplish a little towards the desirable end.

THE PAGAN RACES OF THE MALAY PENINSULA.¹

(With Map and Illustration.)

MEN of business and travellers, whose calling takes them to the Straits Settlements either as settlers or in passing through, are brought into intimate association with the Malay. It is true that the bulk of the

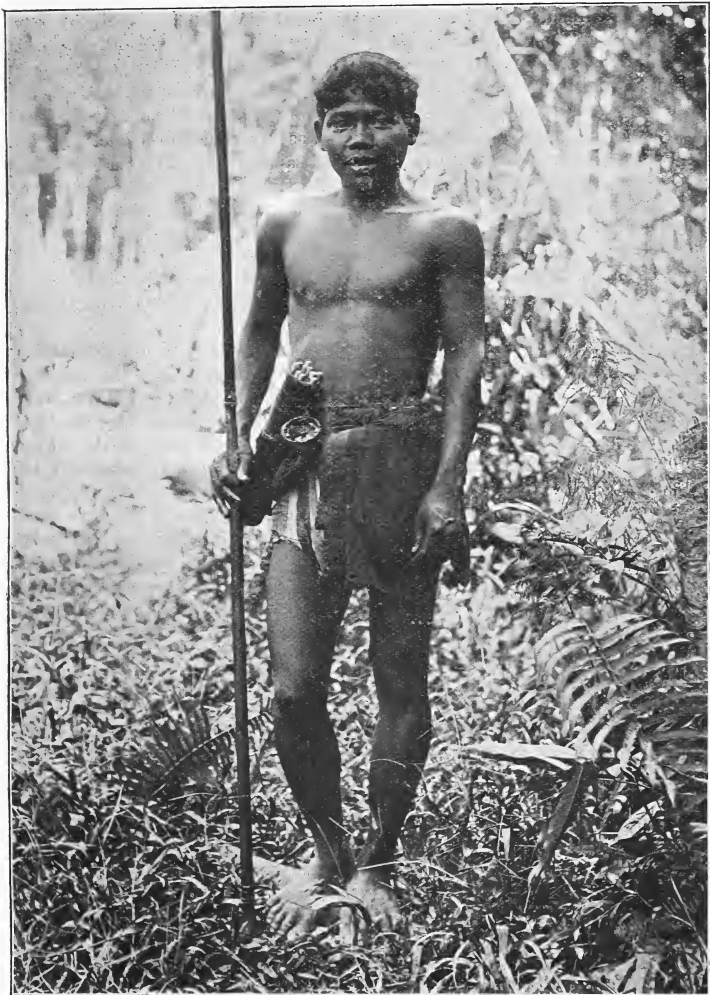
¹ *Pagan Races of the Malay Peninsula*, by W. W. Skeat and C. O. Blagden. London: Macmillan and Co., 1906. In two volumes. With numerous illustrations. Price 42s. net.

commerce, both wholesale and retail, not in the hands of the European, is conducted by Chinese, but the Malay is constantly in evidence. He oftentimes acts as your servant, he is messenger from office to office; he is an expert fisher and boatman. He is a Mohammedan by religion, and is, as a rule, very much a gentleman. We have nothing to do with him for the present; he is not one of the pagan races. But the European is made vaguely aware by hearsay of the existence of another race or races of people who inhabit the mainland of the Peninsula, and the seacoast; an inferior type, more or less dwarfed in stature, who live in the depths of the jungle, feeding on roots and on the prey of their blow-pipes, very primitive and exceedingly shy. If the traveller takes a journey into the interior, the chances are that he will see here and there a dim form flitting among the shadows of the forest trees, an indefinite something which whisks away into nothing. "Orang Jakun, Tuan," ("Jakun, Sir"), his guide will tell him, and he probably dismisses him from his mind as one of the Aborigines, and if he is a collector, he may wonder whether he can effect a deal for the aboriginal weapons. This practically sums up the knowledge which the ordinary European has of these very interesting peoples who are found in the country called the Federated Malay States, and in the islands around. Rudyard Kipling, in *Many Inventions* and under the title of "The Disturber of the Traffic," introduces one variety of the Jakun, the Orang Laut, an astonishingly primitive variety who live on the sea. "You cannot drown an Orange-Lord, not even in Flores Strait on flood time." Laut, however, is pronounced like our Lout.

There has always been, since the commencement of our domination, a small band of earnest scientists who have made a study of the Malay and of these primitive peoples. The copious bibliography published in the volumes under review is ample evidence of this; the names of J. R. Logan, Crawford, and Thomas Braddell are intimately associated with that mine of lore, the *Journal of the Indian Archipelago*, and indeed it would be invidious to make a selection from the roll of distinguished names. Not the least interesting to us will be that of Nelson Annandale, Research Student in Anthropology at the University of Edinburgh, who, as Mr. Skeat says, first broke ground in the Peninsula as a member of the Cambridge Expedition of 1899, and has from time to time published the results of his investigations in the *Fasciculi Malayenses*. And now Mr. W. W. Skeat and Mr. Blagden have given us the outcome of years of study, of arduous journeys and intimate personal knowledge, in this monumental work. Mr. Skeat must rank among the foremost of living Malay scholars and students of the races of the Peninsula, and has already established his reputation by his book on Malay Magic; while Mr. Blagden is responsible for the chapter on the Language question, and for the Comparative Vocabulary—in some ways the most important part of the work.

As the preface indicates, the book is in the nature of a compilation from many sources, with the addition of much original matter; and it is obvious that not only the various chapters, but even sections of chapters, have been written independently and at different times, the result being

occasional "overlapping" of information ; but this is not a disadvantage,



Mixed Jakuu type, Bukit Prual, Selangor.

for one must look on the book rather as an encyclopædia in which the reader will find each heading complete in itself.

Who, then, are these primitive peoples? Whence did they come? There are three well-defined groups which inhabit the central backbone of the Peninsula, the most northerly being the Semang, more or less inland from Penang; the Sakai, on a line from the Perak River; and the Jakuns, a composite race dwelling anywhere between Malacca and Johore, and the islands beyond. Let us begin by admitting that all the theories held up to the present time are only tentative, and that there is a great field for the ethnologist; only, as Mr. Skeat urges, let him be quick, for distinctive features are fast disappearing. The classification adopted is that of Professor Rudolf Martin of Zurich, who has taken the hair as a standard. The only modification which Skeat has made has been to add a standard for the Jakuns. Thus:

Group 1. Ulotrichi, or woolly-haired tribes. Semang.

Group 2. Cymotrichi, or wavy-haired tribes. Sakai.

Group 3. Lissotrichi, or smooth-haired tribes. Jakun and Orang Laut.

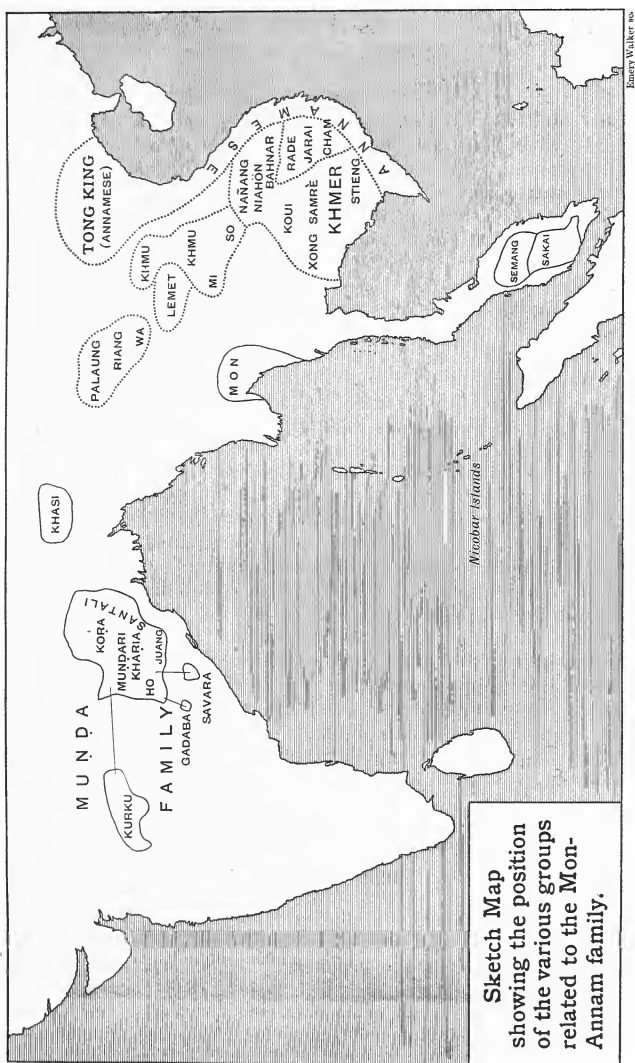
The Semang or *Negrito* is brachycephalic, and in his characteristics is allied to the Philippine negrito, the Andamanese, and the African Pigmies. It has been fairly well established that he is in no way connected either with the Papuan or the African negro. He has two other characteristics; he uses the bow and arrow in place of the blow-pipe, and he builds his huts or shelters on the ground, and not in trees.

The Sakai, on the other hand, is dolichocephalic. There are two theories to account for his origin. One lately advanced by Schmidt seeks to identify him with the Mon-Annam group, an Indo-Chinese source to which we shall refer later. The other, which has the authority of Virchow, suggests that the Sakai is allied to the Vedda, Tamil, Korumba, and Australian races, and may be styled the Dravido-Australian theory. He uses the blow-pipe, a beautifully made instrument, and he builds in trees, or, at any rate, at a height from the ground.

The Jakun, again, is brachycephalic. He belongs to a less well-defined group, consisting of tribes partly aboriginal Malayan, partly Semang, and partly Sakai. He is mongolian or mongoloid.

In discussing the origin of these Pagan Races, it will perhaps clear the ground if we trace what is known of the past history of the dominant Malay race, with whom, as we have said, this work does not concern itself. Swettenham says, in *British Malaya*, page 144, "There are good reasons for believing that Malays are the descendants of people who crossed from the south of India to Sumatra, mixed with a people already inhabiting that island, and gradually spread themselves over the central and most fertile states. . . . From Sumatra they gradually worked their way to Java, to Singapore, and the Malay Peninsula," and so on. Our authors also say of these people, "The Malay language has been introduced into the Peninsula from Central Sumatra, where the Malay-speaking tribes were trained under Indian influences into a more or less civilised condition before they sent out the successive swarms of colonists

who made new homes . . . in the Peninsula" (*Pagan Races*, vol. ii. page



434). It may be noted here that the word Malay is used to denote

this Mohammedan importation from Sumatra, while the term Malayan signifies the aboriginal inhabitants of the Peninsula and the Archipelago. When, then, these Malays arrived on the coast, they found the country already occupied by the Pagan Races, whom they gradually drove into their jungle fastnesses.

The problem which has concerned the ethnologist, and is still vexing him, is how to trace the origin of these peoples. If we examine the map of Asia, we see that, in the tendency of nations to overflow towards the south, the Peninsula is a natural resting-place. It acted as a breakwater against which the fury of the north-east monsoon expended itself, so that even the most primitive praus could coast down from India in comparatively calm water. Moreover, the monsoon, after having spent its force, brought down vessels of all sorts from the China side. In the Malay annals one reads of legends of this kind. In endeavouring to tell what is known of these migrations, we find ourselves in some difficulty, because the subject is still in suspense. There are no records of any kind, and the student has to be guided by race characteristics and by language. We are therefore brought face to face with the problem of the Mon-Annam languages, a study which is yet in its infancy, and which offers a very attractive field for research. The Mon-Annam or Mon-Khmer-Annam tribes coincide very much with what is now called Indo-China. From what distance north they originally came is not known, but it is thought that they spread out towards the north of India, Burma, and Indo-China generally. The reader is directed to the excellent sketch-map which we are permitted to reproduce here, by which he will understand far better than by any description how these allied tribes, arising in the north-east, spread towards the west and south, forming a rough segment of an arc, and established a linguistic and racial connection between the extreme west of the north-west provinces of India and the Malay Peninsula. Originally, before the Burmese and Siamese came from the north, these Mon-Annam races lived, the Mon-speaking in Pegu, the Khmer in Camboga, and the Annam up in Tongking, but the Annamese came gradually down the east coast to where they are now. All this is excellently portrayed in the map. It is thought that when the Sumatra Malays arrived on the scene, they found that the Mon-Khmer races occupied the same relation to the aborigines as to-day the Malays do to the primitive tribes: they occupied the coast-line and generally the points of vantage; they were slowly driven south by races coming after them; and they, in their turn, partly assimilated and partly drove before them into the jungle, the races who are now there.

And now the question arises, Are these pagan races of Mon-Annam origin or not? That is the problem. We are dealing as before with the Semang, Sakai, and Jakuns. The Semang or Negritos are frankly uncertain. They are allied, as we have seen, to isolated tribes far away, as the Philippine negritos and the Andamanese, and there is a large number of words in their language obviously not Mon-Annam. When we come to the Sakai, we notice a slight shade of divergence between the views of the authors, for while, as it seems to us, Mr. Skeat inclines

to the Dravido-Australian theory of Virchow, Mr. Blagden rather holds with the doctrine first suggested by Logan, that the Sakai were at any rate in touch with the Mon-Annam peoples. Schmidt, later, has followed in Blagden's steps and boldly holds the theory that the Sakai are of Mon-Annam origin. Of the Jakuns, less is known. They are a mixed race, a congeries of the "tailings" of various tribes thrown into that corner of the Peninsula from all sides. Their language is as much Archipelago as Peninsular Malay. It has been thought, in order to account for many discrepancies, that there were two Mon-Khmer waves, the one preceding the other by many ages.

The chapters dealing with their modes of living, their hunting and generally gaining a precarious livelihood, are full of interest and will amply repay the reader. One often thinks how instructive it would be if by some magic power one could be transported back to prehistoric times, and see for oneself the process by which primitive man hunted the mammoth and other big game. Well, here we have the operation going on at the present time, if we substitute the elephant for the more ancient animal. These simple people, practically naked, armed only with the blow-pipe and rude implements made of bamboo and hard wood, will with the greatest ease track down and kill not only elephants, but rhinoceros and tigers. The means used are astonishingly simple, but we shall not spoil the description by any paraphrase of our own.

Another chapter full of interest is that which deals with the making of the blow-pipe, and the manufacture of the poison used. A careful description is given of the Ipoh tree, the famed Upas tree of Java (*Antiaris toxicaria*); of the Ipoh creeper, a Strychnos, and very deadly; besides the Tuba, or *Derris elliptica*, used to stupefy the fish.

We have not touched upon the sections dealing with religion and many other points, leaving them to the reader.

One word we must add in commendation of the illustrations. We have seldom seen photographs which were so good in themselves, or so well chosen. We reproduce a striking example here.

PROCEEDINGS OF THE ROYAL SCOTTISH GEOGRAPHICAL SOCIETY.

MEETING OF COUNCIL.

At a Meeting of Council held on the 4th December, the undermentioned ladies and gentlemen were elected Members of the Society:—

Miss J. Milne.	Miss Marion C. Wilson.	Mrs. J. A. Pitcairn.
Adam J. Templeton.	R. W. Waddell.	Miss E. S. Forsyth.
John Hosack.	Mrs. Agnes Pattullo.	William Gow.
James Cowan.	Miss Thomson.	Miss Carmichael.
Charles E. Wardlaw, C.E.	Rev. J. M. Dryerre.	Prof. Alexander Darroch.
Mrs. Finlay.	John J. Brown.	Alexander Orr.
William Mackay, M.A.	W. S. Bertram.	George Carmichael.

James Hutcheon.	James F. Gemmill.	H. F. Morland Simpson,
G. McKay Campbell.	Thomas Jack.	M.A., F.S.A.Scot.
John Graham, M.A., Int.Sc.	William Martin.	Miss M'Nab of Black-
John A. Todd, B.L.	Frank Chalmers.	ruthven.
Miss Magdeline L. Russell.	Miss Margaret F. Simpson.	Miss L. L. Ward.
David Gloag, F.E.I.S.	Thomas Chalmers Addis.	The Rt. Hon. the Earl of
David Ross.	James M. Burnet.	Mansfield.
Miss Margaret L. Russell.	Mrs. E. K. Shepherd.	W. J. S. Eastburn.
R. M. McCheyne Roddick,	J. Barnes Watson.	Mrs. K. C. Hunter.
M.A., F.F.A.	J. Cromar Watt.	William Brown, M.A., M.B.
Francis More.	John T. Frew.	J. Stewart Clark.

CHAIR OF GEOGRAPHY.

Mr. Bartholomew, as Secretary of the Committee for the Promotion of a Chair of Geography in the University of Edinburgh, reported that the Committee, in view of the immediate requirements of Geographical Teaching in the University, had decided to support the establishment of a Lectureship until such time as the Fund permitted of the endowment of a Chair. The Committee accordingly asked the Council to sanction that the interest of the present subscriptions to the Fund, amounting to about £2000, should be given as an annual contribution to the Lectureship. On the motion of Mr. Blaikie, seconded by Mr. Will C. Smith, K.C., this was unanimously agreed to. It was also agreed that the Fund should be invested in the name of the Society's Trustees.

GENERAL MEETING.

The following alterations and additions to the Constitution and Laws of the Society, necessitated by the Resolution which was passed at the Annual General Meeting of the Society held on the 8th November 1906; to admit "Teacher Associates" to certain privileges of the Society at a reduced fee, were considered at a General Meeting of the Society held within the UNITED FREE ASSEMBLY HALL, Mound, Edinburgh, on Wednesday, 12th December 1906, at 8 p.m., and unanimously adopted.

New Law under Chapter I., and Alterations in Laws II. and VIII.

Law II. to read:—The Society shall consist of Ordinary, Teacher Associate, Corresponding, and Honorary Members.

New Law V.—Teacher Associate Members, who must be engaged in the work of teaching and be approved by the Council, may be admitted to certain limited privileges of the Society on payment of a reduced subscription.

Law VIII. to read:—Each Ordinary or Teacher Associate Member whose subscription is not in arrear, and each Corresponding and Honorary Member, shall be entitled to receive periodically a copy of the Society's Magazine, and of such other publications of the Society as the Council may determine.

Additions to Law XVIII.—Every Ordinary Member has the privilege of introducing one visitor to each Meeting. Each Teacher Associate Member shall receive one ticket of admission (non-transferable) to each Meeting.

Addition to Law XXVI.—The Subscription for each Teacher Associate Member shall be Half-a-Guinea, payable on the 1st of November each year.

DIPLOMA OF FELLOWSHIP.

The Council conferred the Honorary Diploma of Fellowship on the Right Hon. Sir George D. Taubman Goldie, P.C., K.C.M.G., F.R.S., D.C.L., LL.D., President of the Royal Geographical Society.

They also conferred the Ordinary Diploma of Fellowship on Henry Martyn Clark, M.D., Thomas Geddes, and Alexander Mackay, C.A., Members of the Society, who had complied with the prescribed conditions.

LECTURES IN JANUARY.

On the 10th January in Dundee, and the 11th in Aberdeen, Miss Marion Newbigin, D.Sc., will deliver a lecture entitled "The Swiss Valais: a Study in Regional Geography."

His Serene Highness the Prince of Monaco, on the 17th January in Edinburgh, and the 18th January in Glasgow, will lecture to the Society on "Meteorological Exploration of the High Atmosphere Phenomena."

Mr. Charles J. Wilson, F.R.S.G.S., will deliver a lecture on "Japan" before the Dundee and Aberdeen Centres on the 29th and 30th January.

On the 31st January, Professor Sir W. M. Ramsay will address the Society in Edinburgh on the "Roads and Railways on the Plateau of Asia Minor."

GEOGRAPHICAL NOTES.

EUROPE.

The Mungo Park Centenary.—On the afternoon of December 10, Sir Harry Johnston unveiled the panels which have been placed in the Mungo Park statue at Selkirk to celebrate the Mungo Park Centenary. In the evening Sir Harry Johnston delivered a lecture on Mungo Park and his work.

Report of the Malta Fever Commission.—In connection with the paper on Malta which was published here last July, it is of interest to notice that, at the annual meeting of the Royal Society of London held on 30th November last, an announcement was made by the Council concerning the work of the Malta Fever Commission. It will be remembered that some time ago Colonel D. Bruce discovered that the cause of the disease was a germ, and the Commission have now ascertained that the main source of propagation of the fever appears to be the milk of infected goats. It is, of course, possible that there may be other contributory causes, such as mosquitoes and house flies;

but it is certainly a remarkable fact that since the Commission in Malta discovered the presence of the germ in the blood and milk of a large proportion of the goats in Malta, and warned the authorities to take the necessary precautions in the use of goats' milk, the number of cases of fever has rapidly diminished. In support of this statement it can be mentioned that, while during the months of July, August and September of last year, 258 men of the Navy and Army suffering from the fever were admitted to hospital, during the same period this year the number sank to twenty-six. Those best qualified to form an opinion believe that if the whole of the infected goats could be removed from the island, Mediterranean fever in Malta would be reduced to insignificant proportions, even if it would not entirely disappear.

ASIA.

The Stein Expedition to Eastern Turkestan.—Dr. Stein, of whose plans we gave some account in vol. xxii, p. 379, is making good progress with his work. From letters published in the daily press at the end of November it appears that he reached Kashgar in June last, and was able to quit that city with his caravan at the end of that month. As about two months were then available before exploration in the desert could begin, Dr. Stein and the surveyor Rai Ram Singh devoted a considerable amount of time to geographical surveying. Dr. Stein finally arrived in Khotan early in August, and, after some further geographical work, began his archæological labours there. Here some interesting finds were made, and the explorer then went to Keriya, whence the letters were written. The point of most geographical interest so far is that he emphasises the fact of the spread of cultivation in the Khotan neighbourhood. Large areas which were waste or covered by desert sand some years ago on his previous visit have now been reclaimed, and water in the Khotan oasis is abundant. The fact is especially interesting as it suggests the danger of overestimating the evidence of gradual desiccation in this region. It may be, as has been suggested by others, that there is an ebb and flow in the relation of desert and cultivated land. Dr. Stein thinks that there is evidence that irrigation on a large scale could be successfully carried out.

Further letters from Keriya, under date October 10, give some additional details as to the extensive survey work carried out by Ram Singh, especially in the region between the Kara-kash and Yurang-kash rivers. At the time of writing Dr. Stein was about to continue his journey eastwards.

The French Archæological Expedition to Central Asia.—In vol. xxi, p. 660, a brief note was given here in regard to an expedition to be undertaken to Central Asia under the leadership of M. Pelliot. It is now reported that the mission arrived at Kashgar in Chinese Turkestan at the end of August last. At the date of the latest advices the explorers intended to proceed from Kashgar to Kucha, in the north of the Tarim basin, thence to the famous Lop Nor, and from there by way of Sa-chu into the valley of the Hoang-ho. After striking across

the great bend of the river from Lan-chau to Singan, they propose to turn north again, and make their way *viâ* Tai-yuan and Tai-tung to Pekin.

Journey to Western Tibet.—Mr. H. Calvert, of the Indian Civil Service, has recently undertaken a journey in Western Tibet, and some particulars of this are given in *The Civil and Military Gazette* of Lahore, quoted in the *Athenæum* of November 10. Mr. Calvert, who was entirely dependent on his Tibetan guides, took the summer route towards Gartok, which he reached on August 4.

By this route Gartok is 122 miles from Shipki, and 344 from Simla. Mr. Calvert penetrated to Chukang on the Indus by an unknown route. He found the Indus here to be "a small stream easily fordable, flowing in a narrow steep valley barely half a mile wide." Rudok, which for some inscrutable reason the Tibetans have most jealously guarded—turning back, for instance, Captain Rawling, on his first tour when he was close to it—is described as "a picturesque village on a rocky eminence in a wide grassy plain. The eminence is crowned by a fine *dzone*, and there are ruined battlements and bastions below. The village is largely in ruins, the population having decreased considerably of late."

Mr. Calvert sums up the results of his journey in the following words: "The entire journey extended over 1080 miles, of which 620 were in Tibet proper. The highest camp was pitched at 17,050 feet, and for weeks we never got below 15,000 feet. The Tibetans were generally friendly or indifferent, and little difficulty was experienced in obtaining yaks for transport. In the course of the tour every district in Western Tibet was visited except those in the south-east corner visited by Mr. Sherring last year. Several previously unknown and unmapped routes were followed, and though no important geographical discoveries were made, much useful and interesting information was obtained. The weather conditions were at times very trying, much rain, hail, and snow being encountered."

AFRICA.

The Results of the Foureau-Lamy Mission.—In this *Magazine* (xvii. p. 416 *et seq.*) some account was given of the Saharan Mission undertaken by M. Foureau, in company with Commandant Lamy, in 1898-1900. The full report of this great undertaking has now appeared in four quarto volumes as *Documents Scientifiques de la Mission Saharienne*, par F. Foureau (Paris, Masson et Cie., 1903-5). The volumes constitute a work of the highest scientific importance, invaluable to all those interested in the regions traversed by the Mission. They include a volume of maps, and volumes devoted to astronomical and meteorological observations, to orography, hydrography, topography and botany, and to geology, ethnography, the prehistoric fauna, and the commercial possibilities of the region. The account already given here makes it, however, impossible to give space for a detailed survey of their contents,

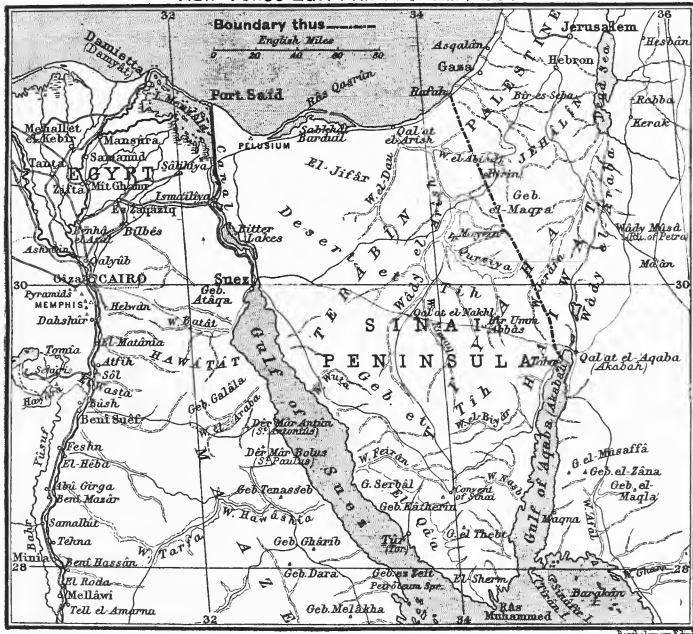
and we can do little more than call attention to the value of the whole, and to the fine illustrations which, in combination with the maps, give so admirable a picture of the great desert. A few words must, however, be devoted to the chapter on *Conclusions Economiques* with which the last volume closes. In effect M. Foureau states that while the experiences of the Mission have dispelled some old fears as to the impossibility of crossing the desert, they but confirm the old accounts of the poverty of the region. It may be that beneath its surface great mineral wealth lies hidden, and M. Foureau is of opinion that careful and detailed investigation should be devoted to this point, but from the surface, throughout by far the greater part of the area, little is to be hoped. By a rational organisation and administration of the country the number of inhabitants can be increased, as also the productivity of certain small tracts, but beyond this the chief hope lies in the possible mineral wealth. As regards the French Sudan, a wise administration is required with the avoidance of the use of Senegalese troops, for these, though excellent fighters, are very undesirable as regular police. Security should be assured and cultivation encouraged by every means in the power of the Government, while money and cloth should be made the sole legal media of exchange. In the Shari and Congo region the desiderata are an improved postal and telegraphic service, a complete utilisation of the existing means of water-transport, and the complete abolition of human portage with the introduction of other methods of transport where possible. Here also cloth and money should be the only media of exchange. M. Foureau concludes by bluntly demanding the removal of all missionaries, of whatever church, it being his opinion that they stir up an amount of strife which more than counterbalances any good they may do.

New Turco-Egyptian Frontier.—We publish here a map to show the course of this boundary as determined by the recent agreement. The task of the Commissioners who represented the Egyptian Government necessitated an amount of exploration which has produced results of considerable geographical importance.

For the first 20 miles the new frontier follows the line of the watershed between the Wadi el Araba on the east, and the feeders of the Wadi el Arîsh on the west. It then crosses an open plateau, drained—if that expression may be used of a sterile upland where a few heavy showers in winter and two or three poor wells alone supply water—by the Wadi el Jerâfa, which runs into the northern portion of the Wadi el Araba, which again slopes towards the Dead Sea, and the Wadi el Qureiya, which runs into the Wadi el Arîsh. From this point the frontier follows the watershed between the Wadi el Arîsh and the wadis of the wilderness of Judæa to Birin, beyond which point the dividing line between the feeders of the former and those of the latter lies in Turkish territory. From the El Auja district to Rafah the country slopes towards the Mediterranean, and the “hard desert” of the Sinai and Arabia Petræa gradually gives way to sandy dunes and steppe till the wells of Rafah are reached.

While the southern half of the frontier line from Aqaba to Mayein traverses an arid and difficult mountainous region, inhabited only by a few Beduin, and very poorly supplied with water, the districts on each side of the line from Mayein to Rafah, especially in the neighbourhood of Ain Kadeis, are described as comparatively well watered and even capable of some agricultural development. Barley is grown as a rain crop by the Beduin of the Wadi el Jaifi and El Kosseima districts; and the springs of Ain Kadeis, Ain el Gedairat, and, above all, of Ain el Kosseima, supply their flocks with abundance of water throughout the

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year. El Auja lies on the Turkish side of the frontier, and is also well supplied with water. In fact, it would be no exaggeration to say that between Ain Kadeis on the Egyptian and El Auja on the Turkish side of the boundary—a distance of at most 25 miles—there is a water supply which, by the construction of a few extemporised cisterns, could be made to suffice for 7000 men, and might be considerably increased by the sinking of new wells.

While the territory between Wadi el Jaifi and the Mediterranean is never likely to hold a large settled population, there is no doubt that the construction of dams across some of the wadis which carry a considerable amount of storm water to the Wadi el Arish during the winter

would enable the Beduin to cultivate barley, tobacco, and vegetables to a much greater extent than is actually the case.

AMERICA.

The San Francisco Earthquake and the Bogoslof Islands.—Papers on the San Francisco earthquake catastrophe accumulate rapidly, in marked contrast to the Valparaiso tremor, information in regard to which is slow in coming to hand. In the *Popular Scientific Monthly* for October, Professor David Starr Jordan gives an interesting account of the actual rift, the article being copiously illustrated by photographs, some of them very striking. Professor Jordan also points out that in the spring of 1906 a fresh island arose in the St. John Bogoslof group in the Behring Sea. The two previous islands arose during earthquake disturbances, and Professor Jordan suggests that the birth of the new island is connected with the great earthquake. In a further paper in the *Popular Science Monthly* for December, an illustrated account is given of these curious islands, and of the origin of each.

The Geography of Alaska.—We have received from the United States Geological Survey an elaborate and beautifully illustrated monograph on the Geography and Geology of Alaska, which forms *Professional Paper* No. 45. The work is professedly a compilation, intended to make the large amount of material which has been accumulated of late years accessible to a wider public, but as the author, Mr. Alfred Brooks, has himself spent seven consecutive years of field work in the province, he speaks with a first-hand knowledge of the problems involved. Mr. Brooks states that his prime purpose has been to disseminate more accurate notions in regard to the geography and geology of the region, and to serve in some measure to dispel the popular fallacies in regard to it, and we fancy that many will find from a perusal of the book that their previous knowledge of the region was largely fallacious. At the base of much popular error, of course, lies the fact that Alaska on an ordinary map of North America is much distorted, so that its true size and position are difficult to realise. A striking little sketch map in the volume shows the province superimposed upon an ordinary map of the States, and makes it clear that the easternmost and westernmost points are separated by a distance equal to that between the Pacific and Atlantic coasts of the States in the latitude of Los Angeles, while the distance between the northernmost and southernmost points is nearly equal to that between the Mexican and Canadian boundaries of the States. With such an extension it is not surprising that there should be great variation in climate, a variation much greater than popular belief allows for. Some of the figures and tables in the section on climate are indeed very striking, especially those relating to rainfall. South-eastern Alaska has a temperate, equable, and remarkably humid climate. Sitka, approximately in the latitude of Aberdeen, has a rainfall of 88 inches per annum, and in the south-eastern region generally the mean annual fall varies from 80 to 130 inches. Two years' records at Fort Tongass, at

the entrance of Dixon Inlet, give indeed an average fall of 133 inches, with a mean annual temperature of 48°. Throughout the district we have cool summers and comparatively warm winters, but during the winter months, which have three-fourths of the precipitation, there is almost incessant rain. On an average there are only about one hundred clear days in the year, and these largely in the spring. In marked contrast with this region is the Alaskan interior, where the climate is continental in character, semi-arid, with an average rainfall of only 11 inches at Eagle, and with great extremes of heat and cold. Space does not permit of a fuller consideration of this or the other interesting topics discussed in the monograph, but those interested in a remarkable region may be confidently referred to Mr. Brooks's work. The section on climate, from which the above observations are quoted, is written by Mr. Cleveland Abbe.

COMMERCIAL GEOGRAPHY.

The World's Production of Rubber.—According to a Report presented by M. Ch. Duffart to the recent Colonial Congress at Marseilles, the actual production of rubber at the present moment amounts to about 56,000 tons, of which 36,800 tons come from America, about 17,500 tons from Africa, and 1700 tons from Asia and Oceania. The French Colonies produce 6600 tons and stand second in the list of productive countries, the amount surpassing that produced by the British territories. The French territories in West Africa constitute the first source of supply, and after them come in order the French Congo, Indo-China, and New Caledonia. At one time the French colonial production went chiefly to England, and in part to Germany, but more and more it is coming direct to France. In 1896 the importation from the Colonies into France was only 317 tons, while in 1904 it was 2378 tons. In 1896, again, the French colonies sent 1258 tons direct to England, and in 1904, 2165 tons, the increase in the latter case being proportionately much less than in the former.

The Industrial Situation in the Southern United States.—We have more than once alluded here to the economic changes which are going on in the Southern States of North America as a result of the altered conditions brought about by the war. A very interesting summing up of the present situation from the standpoint of economic geography is given in an article by Professor Surface in the *Bulletin of the Geographical Society of Philadelphia* (July 1906). The author begins by pointing out that the population in the Southern States in 1900 was twenty-four and a half millions, of which nearly one-third were of negro descent, and about 2 per cent. foreign. As compared with the census of the previous decade, the tendency for the population to accumulate in towns is marked, as is to be expected from the rapid industrial development which is taking place, and there is also a large migration to the less densely populated regions in the west and north-west. Of the total population 18 per cent. are engaged in agriculture, which is still the most important

occupation. Cotton is the only important export crop, and of an estimated 50,000,000 acres capable of bearing this crop in the cotton belt, only about half is actually in bearing, and this in spite of the heavy demand for the product. Even for the present acreage, however, the labour supply is inadequate, and as yet the negro is the only labourer who shows aptitude for the climatic conditions which exist. On the other hand, the development of the towns and the increased demand for domestic servants is more and more attracting the negro away from the cotton belt, and the demand for white labourers in the towns is also great. The diminution of labourers is having the interesting effect of causing the large plantations to be more and more divided up into small farms, which can be worked by the owners for the most part. There is no doubt also that the abundant supply of slave labour in former days has had its usual effect in checking the development of the cotton industry, for an efficient cotton-picking machine would do much to solve the labour problem, as would also a corn harvester adapted to the special conditions in the uplands.

As regards manufactures, we have already emphasised here the rapid growth of cotton manufacture in the south, but the labour problem is here almost as intense as in the fields. Hitherto, as in the earlier development of the cotton industry in England, the demand has been largely met by child labour, but the community are coming to a perception of the economic waste involved. Professor Surface says relatively little of this question, but another journal (*The Annals of the American Academy of Political and Social Science*, March 1906) gives a terrible picture of the conditions now existing. In the South children form 25 per cent. of the wage-earners, and while many States have no regulations on the subject whatever, Alabama and Arkansas, which are among those which have such laws, place *ten* years as the limit of age, the statements made as to age by parents or guardians being taken without inquiry. The origin of child labour is found in the immigration into the towns of whole families, all of whose members, women and children alike, had been accustomed to working in the fields. The whole family similarly went to the factory, with the result that the wages of the whole drop to the level of those earned elsewhere by the adult males. There is even reason to believe that children are imported from the Old World and exploited by persons who are regarded as their legal guardians. The child-labour question occurs not only in connection with cotton manufacture, but also in the tobacco industry, where in North Carolina children form 23 per cent. of the workers, and in mining, where in many States the legal limit for boys is only twelve, a limit to which there is reason to believe very little attention is paid. The student of sociology will be interested to perceive how all the vicious conditions which accompanied child labour in Great Britain are here being repeated, including child marriage, with all its evils.

As the figures given above indicate, foreign labour as yet is not well represented, and hitherto the foreign labourers have not been found very satisfactory, apparently in part because of the method of recruiting employed. There is locally some demand for the importation of Chinese,

Japanese, and Korean labourers for the plantations, on account of their supposed cheapness. Professor Surface expresses the opinion that it is the negro who holds the key to the industrial situation, at least as regards agriculture, and that the aim of the employers should be to endeavour to attract him back to the soil, as he is apparently unsuited for the conditions of town life, and rapidly degenerates there.

EDUCATIONAL.

IN Sir George Goldie's address to the Society, which we publish this month, reference is made to the fact that after July next Geography is to cease to be a subject in Diplomatic and Foreign Office entrance examinations. It is of interest to note that the night after this address was delivered in Edinburgh a question was asked in Parliament on the subject, and the Secretary of State (Sir Edward Grey) replied that "although a knowledge of geography is no doubt useful, it is a subject with which men of general education are generally acquainted, and which is easily acquired after entry into the service." Sir George Goldie has written to the *Times* calling attention to the statements contained in his address, and expressing regret that he finds himself unable to agree with the official position. Most persons will probably agree that the official optimism is hardly justified by experience, so far as the first part of Sir Edward's statement goes, and will be inclined to suppose that although doubtless the subject is sometimes acquired after entrance into the service, yet the knowledge is then often acquired at a cost to the country somewhat out of proportion to its worth.

Following upon Sir George Goldie's letter some other correspondence has appeared in the *Times*. From a letter of Major-General Russell we quote the following instructive paragraph :—

A former Governor of Mauritius has told me that when he applied for the services of a medical officer for the Seychelles Islands, where an epidemic had broken out, he was informed by the Colonial Office that his own medical officer could visit these islands once a week, and hence the extra cost of an additional doctor would be avoided. He replied that the suggestion was excellent, but there were difficulties in carrying it out, as the Seychelles Islands were over 900 miles distant from Mauritius. After this, can it be asserted that well-educated men in this country are usually versed in modern geography ?

Mr. H. J. Mackinder also writes discussing the bearings of the proposed changes. No apology is necessary for quoting from his letter the following concise account of the present position of affairs :—

I hope that Sir Edward Grey will forgive me when I say that his description of geography is twenty years out of date. Twenty years ago there were a few voices already disturbing the wilderness, but for the most part geography was confined to primary education and to the lower secondary education of girls. Persons of superior education were wont as a rule to take pride in their geographical ignorance. At that time the attitude of the Civil Service Commissioners was fully

justified. But I submit that the steps recently taken by nearly all the Universities betoken a change with which even the Commissioners must reckon, whatever the temporary success of the recent strategical move. These steps, it seems to me, constitute a general admission of the inaccuracy of the two assumptions made in Sir Edward's reply in Parliament.

Mr. Mackinder then goes on to detail the position now taken up by most of the Universities of Britain in regard to the subject.

As, however, there can be little doubt that the official attitude still represents to a considerable extent that of the ordinary "educated" person even, it is to be feared, in Scotland, it is perhaps worth while to call attention to the number and variety of the geographical courses available to the student in the German universities. These courses for the present session are detailed in the German geographical journals, and we quote from *Petermann's Mitteilungen* some facts about the courses in geography and the allied subjects open to the student in the University of Berlin. We notice first that in this University *eighteen* professors and *sixteen* Privat-docents are to lecture on geography and the related subjects during the present session. Students may attend courses on mathematical geography, or take practical classes, elementary and advanced, including general geography, cartography and oceanography, lectures on spherical astronomy, and a number of courses or lectures on the taking of astronomical observations, whether for nautical or geographical purposes. They may study anthropology and ethnology, following up the general courses with detailed studies of the folk-lore of special primitive nations, or, on the other hand, correlating their studies with the study of the history of the great civilised nations, ancient or modern. They may study general meteorology and climatology with the prospect of being able to follow these up along special lines. If their interests lead them in the direction of plant-geography, they may study generally the distribution of vegetation over the globe, or the plants of special areas, regarded from their economic aspects. Courses on statistics and geology are also open to them. Again, there are a vast number of lectures or courses on the geography of special regions, often studied in relation to the history and development of the region, and so on—we might continue the list considerably further. While of course no one would suggest that the equipment of a Civil Service candidate should include a knowledge of all these varied topics, the length of the list must surely suggest that modern geography is a big subject, and is not all comprised in one of the ordinary school text-books, nor yet is it a subject which can be utterly neglected when the school days are over. If Germany finds it worth while to have in her universities lectures on her colonies, on their natural products, on their development and resources, and so forth, it would almost seem as if similar courses might be useful in this country. The list just given at least affords some support to Sir George Goldie's view that in the battle of life the nations who take geography seriously are better armed than those who regard it as child's-play, unworthy of the attention of grown men. There is another moral, which it is perhaps unnecessary to emphasise here, that Edinburgh might

profitably draw from the list of professors and lecturers in the Berlin University.

An article by Professor Heilprin, in the *Bulletin of the American Geographical Society* (Sept. 1906), on the "Impressions of a Naturalist in British Guiana," gives an interesting account of the vast primæval forest which stretches from the Amazon to the Orinoco, and may be recommended to the notice of teachers whose classes are studying this part of South America. The contrast between the tropical forest and the familiar woodlands of the temperate zones is well brought out, though it is interesting to note that Professor Heilprin contests Mr. Wallace's familiar statements in regard to the uniform green of the tropical forest. On the water-front, at least, he thinks the display of bloom is not less than in the temperate forest, which is, after all, not a region of brilliant colour like the open fields and waste lands. The paper also contains an interesting account of the animal life of the South American forest, and is full of vivid touches of observation.

The tradition that the Grand Cañon of the Colorado should always be chosen as a typical example of the erosive power of water is so strong that no excuse is necessary for calling the attention of teachers to an article on the Cañon in the *Popular Science Monthly* for November last. The article is based on the new survey of the region, and supplies some figures and illustrations which will be found useful in supplementing and correcting the ordinary text-book accounts. Interesting is the stress laid upon the burden of quartz sand carried by the river as the main erosive agent, while a clear account is given of the different types of rock forming the cañon walls.

NEW BOOKS.

EUROPE.

Cambridge: A Concise Guide to the Town and University. By JOHN WILLIS CLARK, M.A., Hon. Litt.D. Third Edition. Cambridge: Macmillan and Bowes, 1906. Price 1s. net.

The visitor to Cambridge could wish for nothing better than Dr. Clark's complete and yet compact little guide. The colleges are described by one who knows them well, and the descriptions are enhanced by numerous illustrations and plans.

ASIA.

Ostasienfahrt. Von Dr. FRANZ DOFLEIN. Leipzig: B. G. Teubner, 1906. Pp. 511. Price 13 marks.

The Assistant-Keeper of the Royal Bavarian Zoological Museum here gives us his experiences and observations in China, Japan, and Ceylon in 1904. His ship, the *Prinz Heinrich*, was overhauled by a Russian man-of-war in the Red Sea, and was injured on a coral reef in the Indian Ocean. He describes with the amplitude and accuracy of an erudite and scientific man the leading features of the countries through which he travelled, and furnishes beautiful illustrations of the scenery and population, and carefully executed representations of the more novel zoological

forms which he observed. In the course of his scientific investigations in Ceylon he says he came to a district where there was only one white man, "an irrigation engineer, Mr. Ferguson, of Scottish extraction, who, like so many colonial Englishmen, united a deep interest in natural science to very great knowledge." The author devotes a chapter to "the Yellow Peril," and points out that while most merchants have formed a bad opinion of the Japanese as the result of their intercourse with Japanese merchants and sailors, a man of science who comes in contact only with the best classes of the population will form a very favourable opinion of them. He proceeds to examine the Japanese people from a scientific point of view. They regard the family of the nation as supreme, while the individual is only a passing form, thus resembling the animal creation, where individual life is sacrificed in order to maintain the species. Socialistic ideas would find in Japan a fruitful soil, for we see everywhere there traces of communistic or socialistic institutions. The pride, ambition, and enthusiasm of the people place immense power in the hands of an intelligent government. Above all, the Spartan upbringing of the Japanese converts them into a dangerous foe for any European nation. Now, however, Japan is entering on a great crisis. Her social life has not been much altered by her new conditions. Although adopting modern manners, a Japanese man still leads the old life in the midst of his family. But changes in character may occur as the result of the modern education. Already, the author remarked a recrudescence of the less admirable qualities of the people. Their behaviour when peace with Russia was declared showed how dangerous for the state they might become now that they are no longer trammelled by ancient customs. The old foundations of their education—Religion, Ancestor-worship, and Respect for parents—begin to disappear. Europe substitutes nothing, for the Japanese regard her Christianity with scepticism and dislike. Looking to the inflammable character of the Japanese and to the freedom from ancient ideas of the masses in crowded towns, it is probable that demagogues will influence them; and if Western culture leads to the rule of Individualism in Japan, then the chief source of the strength and might of the nation will be destroyed.

Dr. Doffein continues: "In all probability Japan will be a much more powerful political factor than she is at present, but her development is much more difficult to estimate than that of any other nation, partly owing to the character of the Japanese, partly owing to the destruction of their ancient customs." With regard to their commercial competition with Europeans, the author is of opinion that the awakening of the East will do good to German commerce, but that in China British merchants will suffer far more than German from Japanese rivals. He exclaims energetically: "I see no 'yellow peril' in Japan. On the contrary, I hope and believe that we shall derive endless blessing from that country. Japan presses with all her might towards the first rank of rival Powers, and wishes to stand side by side with Britain, the United States, and Germany. As a new factor, she will give them a fresh impetus. We shall have a hard battle, but it will do us good. Our bureaucracy and littlenesses in life and trade will disappear before the giant task we shall encounter by the awakening of non-European nations."

AFRICA.

The Making of Modern Egypt. By Sir AUCKLAND COLVIN, K.C.S.I., K.C.M.G., C.I.E. London: Seeley and Co., 1906. Price 18s. net.

During the last ten or twenty years we have had many books and reports dealing, directly or indirectly, with the making of modern Egypt. It is a tale

that bears repetition ; for it would be difficult, if not impossible, to select a period of twenty-two years in the history of the colonies or dependencies of England or of any other country which would more successfully illustrate the saying that truth is stranger than fiction, or would compare in national, general, and romantic interest with the twenty-two years between 1882 and 1904, *i.e.* the period assigned to "the making of Modern Egypt" by the writer of the book. In perusing any book on this subject comparisons with the brilliant works and reports of Lord Cromer, Milner, Dawkins, Scott, and others are inevitable, but we may say at once that the author of this work has nothing to fear from a comparison with the works of his predecessors. Sir Auckland Colvin has special qualifications for the task he undertook. He is an Indian Civil Servant, who has risen through all the grades of that distinguished service to being Lieutenant-Governor of the North-Western Provinces and Oudh, and for some years he was British Comptroller-General of Egypt and Financial Adviser to the Khedive. He has thus brought to the preparation of this work a special intimate experience and a statesmanlike breadth of view, the advantages of which become more and more obvious as the work proceeds. The story is the record of the triumph of Lord Cromer, of whom Sir Auckland is an acknowledged admirer. "The central figure," he writes, "has been the British Minister and Agent. Cabinets in London, in Paris, and in Cairo have come and gone ; diplomatists have fretted their hour on the stage, and have faded into obscurity. Able and devoted subordinates have in turn assisted the British Agent ; and, their term accomplished, have passed on to other labours. Lord Cromer alone has remained throughout ; in him, during more than twenty years, the life of Egypt has centred, and from him all energy has radiated. The making of modern Egypt is the work of Lord Cromer."

Undoubtedly the figure of Lord Cromer stands out high above those who may claim to have had a share in the making of modern Egypt, but he has been the first to acknowledge that he has had many able and strenuous subordinates, without whose help his task would have been impossible. Sir Auckland Colvin does ample justice to them also, and it is pleasant to find him writing in most cordial terms of his French colleagues, of whom many a hard thing was said not so long ago. In his estimate of them Sir Auckland's exceptionally wide experience of men and manners has stood him in good stead, and an extract of his appreciation of their character and services is worth quoting, especially as it furnishes a good example of the brilliant style in which this book is written. The French officials in Egypt, he says, "were for the most part men of marked ability and untiring industry. . . . Keen of wit, incisive of tongue, choleric of disposition, sensitive as children, kindly as women, the Frenchman was the very opposite of the phlegmatic, imperturbable Briton whom he lugged along with him in his heated course. Which of the pair did the most useful work it was not always easy to say, but the paces and showy movement of the Frenchmen were effective. They were never seen in the tennis-court, nor in the saddle ; nor did field sports attract them. Constant and often heated discussion with one another was their relaxation ; the black official portfolio their symbol ; the frock-coat their habitual garb. There must have been something abhorrent to their passion for correctness in the negligent costume, the slack disregard of formality, the indifference to the outward and visible signs of office, which in Egypt, as elsewhere, distinguish Englishmen. But difference of temperament and of training seemed to draw together, rather than to repel. To their honour be it said, the French sought to do their duty as conscientiously by the country which employed them, and by the colleagues who worked with them, as though their portion had been in France, and their colleagues of their own nation. . . . Whatever the verdict of their countrymen

may have been, British colleagues recognised that their French associates were good men and true ; worthy representatives of the great country from which they came ; pleasant in their private lives, as in public life they were above reproach. De Bligni res, Bellaigue de Bughas, Bouterou, are gone to the silent land (if any land, indeed, be silent where the spirits of the French dead do congregate) ; Liron d'Airolles, Gay Lussac, Barois, and others, happily remain with us."

The history of these twenty-two years during which modern Egypt was being made is a tangled skein, of which it is impossible in the space at our disposal to give even a sketch. But we refer our readers to Sir Auckland Colvin's interesting, impartial, and graphic history, assured that the perusal of it will satisfy all that the work accomplished in Egypt is one of which the English, and, we must add, the French nation, may well be proud. And yet an experienced administrator and competent judge, viz. Sir Auckland himself, likens it to the barrage, which may be described as the life-blood of Egypt. "The barrage," he says, "is a replica of the British position in Egypt. It initiated in French action. It is built upon unstable foundations ; yet, with constant caution, they can be regarded as secure. It is essential, in the interests of the population, that the barrage should be placed under the care of Europeans. It is patchwork, but brilliant patchwork. It holds up the vitalising forces of the country, and distributes them to the best advantage." *Mutatis mutandis* ; the same may be said of the British position in Egypt to-day.

The last chapters of the work are devoted to a description of the present condition and prospects of the Soudan, now an integral part of Egypt, with an area of over a million square miles, and a population of under two millions of souls, and presenting difficulties and problems which demand the most consummate statesmanship and patience. The contrast between Egypt and the Soudan is remarkable. "The Egyptian is laborious ; the Soudani, if he is an Arab, scorns labour ; if he is a black man, he cannot be induced, except by hunger or scourge, to undergo any but the lightest toil. The fertility of the soil of Egypt has passed into a proverb ; in the Soudan irrigation is in its infancy, and the greater part of the country has never received a drop of water from any of the great rivers which traverse it. In Egypt distances are inconsiderable, and means of transit abound ; the distances in the Soudan are immense, and transit is still mainly confined to that most ancient friend of man, the camel. The seaboard is easily accessible to all Egypt ; to the greater part of the Soudan it is most difficult of access, and to many provinces it is wholly unknown. The climate of Egypt is far from unhealthy to the white man ; the Soudan in part spells death to him, and almost everywhere, for many months in the year, is oppressive and enervating. Finally, the Egyptian is a quiet subject, and averse from arms ; the Soudan is full of fierce fighting men, of fearless Arab descent, and of excitable and savage black races, both Muhammedan and heathen, but alike ignorant and impulsive, whose fanaticism may be fanned into flame at any moment, and whose loyalty depends rather on personal regard for individual rulers than on acquiescence in foreign rule, or on acceptance of European guidance. . . . Imagination fails to picture those illimitable regions, the endless swamps, the weary waterless distances, the mighty rivers, the interminable deserts, the great silence, the scattered, sparse, and diverse people, the little band of British officers working out their lives in solitude, discomfort, and ill-health, while watching over the painful labours which precede the coming of a new life."

The genius of the British race for colonisation and for government has been tested and proved in many ways, on many a shore and in many a climate, and we know that often the task of colonisation or government has come on us as an un-

expected, and often an unwelcome, task or duty. But this cannot be said of the regeneration and civilisation of the Soudan, a Herculean task, but one deliberately undertaken, the dangers and difficulties of which are only now being appreciated; and it will tax the genius and statesmanship of England to an extent which, perhaps fortunately, we are slow to realise. Sir Auckland says, "There has never, probably, in the history of the world been such a deliberate experiment in the reclamation of mankind over so large an area; nor perhaps such an incongruous couple engaged in it as the blunt Briton from the Thames and his slim coadjutor from the Nile. Which will prove to have been the better forecast, the pessimism of General Gordon, or the optimism of Lord Cromer, it is not for the present generation to divine. Will Great Britain echo the boast of another imperial race, and be rewarded hereafter by the love of those *quos domuit, nexaque più longinque revinxit*? Or will she share the destiny of the mythical benefactors of whom the Latin poet sang? of the disillusioned demi-gods, whose labours, identical in character with her own, brought them no adequate meed of acknowledgment?" In times like those of to-day, when the political arena rings with the scarcely intelligible battle-cries of mere sects and parties, we can remember with relief and pleasure that elsewhere in the world, and certainly in Egypt and the Soudan, the political constructive genius, which made England what it is, is still at work on a task worthy of its great traditions, and has enough material on which to exercise its highest powers for many years to come. It will be a happy day for the Soudan if, some twenty or twenty-five years hence, a Sir Auckland Colvin of these days is able to record for the Soudan as brilliant a success in constructive statesmanship as this thoughtful and instructive work now records for the land of the Pharaohs.

GENERAL.

Kinglake's Eothen. With an Introduction and Notes, by D. S. HOGARTH.
London: Henry Frowde, 1906. Price 2s. 6d.

This dainty little reprint has not much direct geographical interest, either as regards text or notes, but is of interest in throwing light upon the conditions of life in the East at the date when the book was written.

Brown's Comprehensive Nautical Almanack for 1907. Glasgow:
Brown and Son, 1906. Price 1s.

We have received the new issue of this invaluable publication, revised and corrected to date. According to a notice sent with the volume, the 1907 edition is published in two forms, the ordinary and an edition on thicker and better paper containing some additional information. To the scientific geographer, no less than the navigator, the information contained in the Almanack is indispensable, and we extend to it our annual welcome.

BOOKS RECEIVED.

The Passing of Korea. By HOMER B. HULBERT, A.M., F.R.G.S. Illustrated from Photographs. Royal 8vo. Pp. xii + 473. Price 16s. net. London: William Heinemann, 1906.

Un Crépuscule d'Islam. Maroc. Par ANDRÉ CHEVRILLON. Crown 8vo. Pp. 315. 3 fr. 5. Paris: Librairie Hachette et Cie.

The World of To-Day. Volume vi. A Survey of the Lands and Peoples of the Globe as seen in Travel and Commerce. By A. R. HOPE MONCRIEFF. Pp. vi + 380. Price 8s. net. London : The Gresham Publishing Co., 1906.

Sketches from Normandy. By LOUIS BECKE. Crown 8vo. Pp. 250. Price 6s. net. London : T. Werner Laurie, 1906.

Edinburgh under Sir Walter Scott. By W. T. FYFE. With an Introduction by R. S. RAIT. Demy 8vo. Pp. xxi + 314. Price 10s. 6d. net. London : Archibald Constable and Co., 1906.

My Pilgrimage to the Wise Men of the East. By MONCURE DANIEL CONWAY. Royal 8vo. Pp. viii + 416. Price 12s. 6d. London : Archibald Constable and Co., 1906.

Modern Spain, 1815-1898. By H. BUTLER CLARKE, M.A. With a Memoir by the Rev. W. H. HUTTON, B.D. Crown 8vo. Pp. xxvi + 510. Price 7s. 6d. Cambridge : University Press, 1906.

La Chine novatrice et guerrière. Par le Capitaine D'OLLONE. Un volume in 18. Pp. viii + 319. Price 3 fr. 50. Paris : Armand Colin et Cie., 1906.

The Dawn of Modern Geography. Vol. III. A History of Exploration and Geographical Science from the Middle of the Thirteenth to the Early Years of the Fifteenth Century. By C. RAYMOND BEAZLEY, M.A., F.R.G.S. (c. A.D. 1260-1420.) 8vo. Pp. xvi + 638. Price 20s. net. Oxford : Clarendon Press, 1906.

Natives of Australia. By N. W. THOMAS, M.A. (Native Races of the British Empire.) Demy 8vo. Pp. xii + 256. Price 6s. net. London : Archibald Constable and Co., 1906.

The Romance of an Eastern Capital. By F. B. BRADLEY-BIRT, B.A., F.R.G.S., I.C.S. Demy 8vo. Pp. x + 349. Price 12s. 6d. net. London : Smith, Elder and Co., 1906.

The Lower Niger and its Tribes. By Major ARTHUR GLYN LEONARD. Demy 8vo. Pp. xxii + 559. Price 12s. 6d. net. London : Macmillan and Co., 1906.

Also the following Reports, etc.:—

Central Provinces District Gazetteer. 17 Parts. Edited by R. V. RUSSELL, I.C.S. Allahabad, 1904-1905.

Punjab District Gazetteer. Vol. XIII-A. With Maps, 1904. Lahore, 1906.

A Report on the Work of the Survey Department in 1905. By Captain H. G. LYONS, D.Sc., F.R.S., Director-General. Pp. 76. Cairo, 1906.

Twenty-fourth Annual Report of the Fishery Board for Scotland for the Year 1905. Part III. Scientific Investigations. Glasgow, 1906.

British Guiana Blue Book, 1905-1906. Georgetown, Demerara, 1906.

Punjab District Gazetteers. Delhi District. Lahore, 1904.

Madras District Gazetteers. Vol. II. 3 Parts. Madras, 1906.

Bengal District Gazetteers. By L. S. S. O'MALLEY. Vol. I. Calcutta, 1906.

District Gazetteers. Statistics, 1901-1902. 38 Parts. Calcutta, 1906.

Western Australian Year-Book, 1902-4 (Thirteenth Edition). By MALCOLM A. C. FRASER, F.R.G.S., F.S.S., F.R.C.Inst. Pp. x + 1283. Perth, 1906.

Military Report on Egypt, 1906. Prepared for the General Staff, War Office. Maps. London, 1906.

The Science Year-Book: Diary, Directory, and Scientific Summary, 1907. Edited by Major B. F. S. BADEN-POWELL. Pp. 362. Price 5s. London : King, Sell and Olding, 1907.

Publishers forwarding books for review will greatly oblige by marking the price in clear figures, especially in the case of foreign books.



H.S.H. THE PRINCE OF MONACO

THE SCOTTISH GEOGRAPHICAL MAGAZINE.

H.S.H. THE PRINCE OF MONACO.

(*With Portrait.*)

H.S.H. ALBERT 1ST, PRINCE OF MONACO, to whom the Society's Gold Medal for 1906 was presented in Edinburgh on January 17th last, is distinguished for the important services which he has rendered to oceanography. On a previous visit to Edinburgh on July 15, 1891, the Prince read a paper before the Royal Society on "A New Ship for Oceanographic Work." Before that time he had been devoting his attention to oceanographical research in a small vessel, the *Hirondelle*. In this ship, in the years from 1885 to 1891, he made many studies in oceanographical science, especially on the marine fauna of great depths, and this has been also his object in subsequent voyages for a period of twenty-one years. The *Hirondelle* being found to be too small for the requirements of the work, a three-masted schooner, with auxiliary engines, was built in 1891. This schooner, named the *Princesse Alice*, was used until 1898. She, in turn, proved to be too small, and was replaced by a full-powered steamship of more than 1400 tons. In 1892 the Prince of Monaco again visited Scotland, and contributed a paper to the Edinburgh meeting of the British Association. Subsequently, besides carrying on deep-sea work, he undertook a new investigation. He had for many years taken much interest in meteorology, especially as connected with the ocean, and had developed the study of this science on Atlantic islands. He now undertook investigations, by means of kites and balloons, in the higher atmosphere. Not content with his investigations in the regions of the trade winds, he turned his attention to the Polar regions, and last year he made, as already noted here, his third cruise to Spitsbergen and the neighbouring seas. There he carried out a series of successful and interesting experiments with meteorological kites and balloons, and also, with the assistance of French, Norwegian, and Scottish parties, undertook a detailed survey of a large part of the

north-west of Spitsbergen and Prince Charles Foreland. In 1899 the foundation stone of the great Oceanographical Museum of Monaco was laid, under the patronage of the German Emperor; and last year, as we have also recorded, the Prince of Monaco founded an institute in Paris, with an international committee, associated with his collections in Monaco. This institute he endowed to the extent of £160,000. Almost every European country has some prominent scientists who have been definitely associated with the oceanographical and meteorological work of the Prince of Monaco. In this country there are associated with him the names of Mr. J. Y. Buchanan, whose scientific researches on board the *Princesse Alice* and at the Monaco Museum have been of much importance; Mr. W. S. Bruce, of the *Scotia*, who accompanied him on all his Arctic voyages; and Mr. W. Smith, junr., Aberdeen, who sailed with him in 1899 as artist.

The Prince is further associated with oceanographical research in this country, in that during his recent visit he presided at the inauguration of the Scottish Oceanographical Laboratory, and was there met by a representative gathering of Scottish men of science and others. At the close of the meeting the Prince was asked by Mr. W. S. Bruce, the Director of the Laboratory, to accept a replica of the medal which had been presented to the members of the Scottish National Antarctic Expedition, as an acknowledgment of the valuable services which he had rendered to the expedition by the loan of instruments and in other ways, and also as a memento of his association with the new Institution. The Prince is thus not only himself a scientific investigator, but has also been associated in more than one country with the promotion of scientific research by others.

THE NIGER BASIN AND MUNGO PARK.¹

(*With Map.*)

By Sir HARRY H. JOHNSTON, G.C.M.G., K.C.B.

IN 1603 the Scottish people discovered England as a field for adventure and enterprise. In the middle of the seventeenth century, and from thence to the beginning of the eighteenth, they carried out an equally remarkable work of exploration and settlement in Ireland. But it was after the union of the legislatures of England and Scotland that the Scottish people really embarked on their great career as pioneers of discovery and commercial adventure. Entering then for the first time fully into the privilege of subjects of the British Crown under a dynasty still Scottish in direct origin, the Scots rapidly made themselves famous in the history of the world's development by their enterprise in Central

¹ An Address delivered at Selkirk on December 10, 1906, in connection with the unveiling of the centenary memorial panels in the Mungo Park statue.

America, the West Indies, India and Africa. James Bruce, born at Kinnaird House, Stirlingshire, in 1730, was sent to Harrow to be educated, and from there was despatched by his father to work in the wine business between Spain, northern Portugal, and Great Britain. But Bruce's ambitions led him far beyond the Spanish peninsula into North Africa, where he was appointed Consul-General, and later on to Egypt, from which country he made his celebrated exploration of the Blue Nile and Abyssinia. He did not discover, as he had thought, the ultimate source of the Nile: that good fortune was to fall jointly to the lot of an Englishman, Speke, and a Scotsman, Grant. Were it not very certain that the source of the Blue Nile had really been discovered by Portuguese missionaries in the sixteenth and seventeenth centuries and that therefore Bruce, unknown to himself, had been forestalled, Scotland would have had a two-thirds share in the glory of discovering the origin of the two upper head-streams of the Nile. Another great Scot, David Livingstone, revealed to us the principal sources of the Zambezi and the Congo. In 1777 a Scottish explorer, Captain Robert Jacob Gordon, discovered the Orange River of South Africa, which has since played such a considerable part in the delimitation of South African states. Perhaps in proper sequence I should have mentioned that the first explorer of North Africa (Tunis and Algeria) who gave an account of his travels in the more modern style was William Lithgow, who at the commencement of the seventeenth century—about 1610—travelled through parts of Algeria and Tunis. During the eighteenth century adventurous Scots found their way to Morocco or Algeria, most often unwillingly, being captured by Moorish pirates, and making their first experiences of Northern Africa as captives. They generally secured their freedom through their hard work and skill, obtaining recognition in the eyes of some local potentate, or by the more prosaic way of being ransomed, or possibly released at the end of some treaty-making with a Dey, a Bey, or a Sultan. Apparently some of these Scottish adventurers returned to the ports of Morocco or Algeria in a trading, or even in a consular capacity, and several of them took part in the newly arisen Liverpool trade with West Africa in the eighteenth century, thereby finding their way to the Senegal, Gambia, Sierra Leone and the Gold Coast.

The greatest hero, however, of Scottish exploration in the eighteenth century was Mungo Park, to honour whose memory we are assembled here to-night. It is of him and the results of his work that I shall treat principally; but before I begin to describe his truly remarkable journeys, perhaps you will allow me to give some description of their main object—the solution of the Niger mystery.

Towards the close of the eighteenth century, public curiosity as to the ultimate source of the Nile was for a time set at rest by the journeys of Bruce. Whether or not Bruce had been preceded by the Portuguese, no one a hundred odd years ago (except perhaps a French geographer, D'Anville) had any doubt that the main stream of the Nile was the Abyssinian river. What therefore now attracted scientific curiosity was the course and outlet of the Niger. The Greek writers on geography in

the centuries that preceded the Roman Empire collected from their intercourse with the people of the southern Mediterranean, especially the Carthaginians and Egyptians, vague rumours of a fertile, well-watered region beyond the Sahara Desert, faint indications not only of the origin and course of the Nile, but also of some other Nile, some other great river or lake in West Central Africa. The Romans, when they took possession of the North African states, made at least one expedition to the southern regions of Morocco, and a still more remarkable one under Julius Maternus through Tripoli southwards into Fezan, and apparently from Fezan to somewhere in the neighbourhood of Bilma, that is to say, within no very great distance of Lake Chad. The stories gathered up by them and transmitted to us in the writings of Plinius Secundus, who was born at Verona in A.D. 23, pay much attention to the geography of Morocco, though the southward extent of this country is no doubt much exaggerated and confounded in Pliny's mind with vague traditions which may have reached him of Carthaginian journeys along the north-west coast of Africa. Pliny mentions repeatedly a great river flowing to the southward of Morocco called the Gir or Nigir. Much of his information, no doubt, relates to the River Draa, which is the southern boundary of Morocco, and is a very important watercourse draining the southern part of the Atlas Mountains—a river, however, which probably never flows to the sea in one continuous stream more than once in every few years, for a few weeks. There is nothing about this river to suggest well-watered tropical regions, nor are there in it any hippopotami or crocodiles. But in his description of the great River Nigir, Pliny, though he places it very much where the River Draa is found at the present day, was evidently repeating stories of the Bambotus or Senegal of the real Niger. It is very nearly certain that the Senegal River had been revealed to the knowledge of the Caucasian race by Hanno or other Carthaginian maritime adventurers. A knowledge of it spread from Carthaginian sources to Greek writers, and the description given of the fauna and of the vegetation makes it certain that, some five hundred years before Christ, the Mediterranean world had a glimmering knowledge of the regions of Atlantic Africa beyond the Sahara Desert; they knew, that is to say, that beyond the limits of this arid region there were hot lands through which copious rivers flowed, lands of strange wild beasts and of savage, naked men. Such information as reached the Mediterranean by the commencement of the Christian era may have suggested to ancient Greeks or Romans the existence in West Africa of another mighty river similar in many of its characteristics to the Nile, perhaps even, in the minds of some geographers, the ultimate head-waters of the Nile, which by an extraordinary curve reached Ethiopia and then turned at right angles to the Mediterranean.

With the irruption of the Barbarians into the Roman Empire, all interest in geography died away so far as Western Europe was concerned, while the Byzantine Empire limited its curiosity to the regions of the East. It was the Arabs who were to take up the geographical work commenced by Herodotus and continued by Aristotle and Strabo, Pliny, and Ptolemy of Alexandria. The Arabs invaded North Africa in 640

A.D. They rapidly imparted their religion and language to the Berber tribes whom they so strongly resembled in physical characteristics and mode of life, even their languages having a very remote affinity. In the ninth century the Arabs seem to have penetrated into Negro Africa due west from the Nile, and across some old caravan routes from Tripoli to the northern bend of the Niger. In the tenth century they had already produced maps indicating an actual knowledge of the regions south of the Sahara Desert. By about the year 950 A.D. some of their pioneers had travelled along the Atlantic coast south of Morocco till they reached the mouth of the Senegal. They then wandered eastwards up the course of that river and across the water-parting to the Upper Niger, on which river they probably met other pioneers of Islam who had penetrated through the regions of Lake Chad to the northern bend of the Niger. By the beginning of the eleventh century Muhammadanism and Arab influence had completely dominated the valley of the Niger, from its entry into the Sahara Desert near Timbuktu almost to its source. Great Muhammadan kingdoms arose in the lands of the Mandingo round about the Upper Niger, and the mysterious Fula race between the Niger and the Senegal became converted to the faith of Muhammad. In fact, in the eleventh century a great proselytising movement led a tribe of Berbers, the Murabitin or Moravides, across the Sahara Desert to Morocco and Spain, once more reconquering for Islam the Spanish peninsula. This, I think, was one of the most extraordinary episodes in the history of Africa: that at the commencement of the Middle Ages a wild race of Tawareq nomads should start from the Niger and in a very few years overrun Morocco, Algeria, and nearly all Spain and Portugal, thus staving off for another four hundred years the collapse of Islam in Western Europe.

All these movements of Arabs and Arabised Berbers and Negroes implanted very firmly in civilised Morocco—for Morocco was then a country of high civilisation—the knowledge of the existence of a great river in West Africa beyond the Desert. This river was much confused with the Senegal. Some people thought that the Niger—as it came afterwards to be called—flowed from Lake Chad more or less due west till it entered the sea through the mouth of the Senegal. This was the impression made on the minds of those European adventurers who coasted along North-West Africa in the fourteenth century. Some of these bold Normans from Dieppe, Genoese or Majorcans, probably visited the Senegal. They brought back stories of a river of gold, which greatly excited the cupidity and interest of the Portuguese. Through their intercourse with Morocco, which they had partially conquered, the Portuguese heard from their Moorish captives these stories of the Great River beyond the Desert. Being at the same time industrious students of the Classics in the revival of learning which had followed the erection of Portugal into a Christian kingdom, the Portuguese identified the Great River beyond the Desert, the River of Gold, the river of crocodiles and sea-horses, with the “Nigir” of Pliny, and it was probably the Portuguese who first invented the modern name of the river which by a slight variation we call “Niger.”

It seems possible, however, that the Portuguese were not the first amongst the Latin nations to reach Western Tropical Africa beyond the Sahara Desert. In the thirteenth century the Genoese navigators had rediscovered the Canary Islands, and in the fourteenth century Normans from Dieppe, Genoese and Catalans from Majorca, had sailed down past the limits of the Sahara to the Senegal River, and even onwards to the coast of modern Liberia (where the Norman French claimed to have established themselves for nearly a hundred years) as far as Elmina on the Gold Coast. The Genoese navigators even may have penetrated further, and perhaps may have returned in safety, but leaving no definite record of their achievement; for all Italian maps of the fourteenth and early fifteenth centuries, sixty or seventy years at least before the Portuguese discoveries, gave a delineation of the African continent which on its west coast is strikingly like actuality. But from various causes to do with European history, these efforts emanating from the south coast of the British Channel and the north coast of the Mediterranean came to an end in the early part of the fifteenth century, or were fused with the now stirring tale of Portuguese adventure which began under the direct impulse of Prince Henry the Navigator. Genoese and Venetian captains took service with the crown of Portugal. In 1444 the Portuguese ships reached the mouth of the Senegal River. This was at the time identified with the River of Gold or the Western Nile of the Arabs or with the Nigir or Niger of Pliny. In 1456 the remarkable Venetian navigator, Ca' da Mosto, in the service of Portugal visited the Senegal and Gambia Rivers, and appears to have made a journey inland for some distance along the course of the Senegal. From intercourse with the Moors he brought back stories of the Niger River and Timbuktu, and above all of a wonderful city or country called Guiné or Ghinala. These stories seem to have had for origin the remarkable civilisation of Jene, a well-known town and district on the Upper Niger, constantly the headquarters of a powerful Muhammadan kingdom either under the Mandingos or the Fulas.

From this time onwards till the eighteenth century either the Senegal or the Gambia were looked upon as the outlet into the sea of a great river flowing from a lake in the heart of Africa (Lake Chad, in fact) to the Atlantic. The Moorish stories of a great watercourse running east and west¹ muddled European geography for several centuries. All round the Atlantic coast of Guinea may be observed one great estuary after another. Every few miles from the Senegal southward one encounters an important river mouth. It might well be supposed, therefore, that these multitudinous estuaries constituted perhaps the vast delta of a great river draining at least a third of tropical Africa. Besides the thirst for gold, which for a time was partially slaked by the discovery of the Gold Coast, European covetousness was attracted towards the basin of the Niger, a land which was felt vaguely to be analogous to the Moslem East. Portuguese explorers had penetrated inland from the

¹ The Senegal, Niger, Komadugu, Lake Chad and Bahr-el-Ghazal appeared evidently to the first Arab explorers to be one continuous waterway.

Gold Coast to the verge of the Niger watershed in that direction, at any rate to lands beyond the forest, under the influence of some semi-civilised Muhammadan peoples. The civilisation, in fact, of the Niger basin between the sources of that river and the falls of Bussa was very nearly on a par with the European civilisation of the fifteenth and sixteenth centuries. There is very little doubt that the valley of the Upper Niger north of 10° N. lat. has for many centuries been lifted above mere savagery—above that savagery which was the almost unbroken quality of the Guinea coast belt from the Gambia to the Niger Delta, the Congo and the Cape of Good Hope, prior to the Portuguese settlement of the fifteenth and sixteenth centuries. Some have even supposed that the influence of the Caucasian, which is everywhere, I believe (except in America), synonymous with the Neolithic Age and the raising of Man from a condition of barbarism, emanated from Ancient Egypt: that something of Egyptian civilisation, including the domestic animals of Egypt, found its way from the middle Nile across Kordofan and Darfur to the basin of Lake Chad and thence to the Upper Niger, while at a later date the Libyans of North Africa and the Sahara Desert, who are absolutely of Caucasian stock, found their way across the Sahara Desert with the aid of oxen and camels and permeated the healthy regions of the Upper Niger. Some, like myself, believe the Fulas to have been a Caucasian race of North Africa speaking a type of language antecedent to the Berber and Semitic tongues, and driven from North-West Africa into Negro-land by the advent of the Iberians, who brought with them from southern Europe a type of language from which the modern Hamitic and Semitic tongues are descended. At any rate the civilisation of the Niger seems to be older than the irruption of Islam and the Islamic Arabs and Moors into that region.

It was therefore towards something like a western India, a land of gold, and also a land of well-clothed, turbaned people riding on horses or donkeys, a land of well-built cities and much material comfort, that European adventure was so strongly attracted from the fifteenth century onwards. The British were not slow to be infected with this search for the Niger River and the far-famed city of Timbuktu. In the seventeenth century a British company was formed to explore the Gambia with the object of reaching the Niger. The first explorer sent out by this enterprise, Richard Thomson, eventually met with a disaster, being murdered at the instigation of the Portuguese, but he was succeeded by Richard Jobson, who ventured a considerable distance up the Gambia—about three hundred miles. He failed, however, to reach the Niger, and for nearly a hundred years enterprise in this direction on the part of the British was stopped. The French, however, had taken the matter up by way of the Senegal. Their explorations, however, showed conclusively that the Senegal and the Gambia also were rivers quite independent of the Niger system. This was confirmed by Captain Bartholomew Stibbs, who explored the Gambia on behalf of a British company in 1723.

In the middle of the eighteenth century, Lord Halifax, a British statesman, became much interested in African exploration, especially as

regards the source of the Nile. It was he who made the great Scottish traveller, Bruce—one of the first *scientific* explorers—Consul or Consul-General in Algeria, and then furnished him with the means to penetrate far into North-Eastern Africa. Bruce's preliminary work in Algeria, Tunis and Tripoli so whetted the curiosity of scientific men in England and Scotland as to the marvels of interior Africa that it led indirectly to the foundation of the African Association, which proved such a potent instrument in African discovery, and which was the direct parent of the Royal Geographical Society of London. The moving spirit of this association was Sir Joseph Banks, and it was Sir Joseph Banks who selected Mungo Park for the exploration of the Niger. The African Association had despatched a daring but too eccentric American seaman, Ledyard, to Egypt, with the idea that he should cross the African continent and come out on the Guinea coast, but he died soon after his arrival in Egypt. Another traveller despatched in 1789 was Horneman, an ancestor, I believe, of the founder of the famous tea firm. Horneman, we now know, made a most marvellous journey. He started from Tripoli in 1789, crossed the Sahara, and almost, if not quite, reached the Lower Niger. He seems to have died in the Nupe country, which is now the headquarters of British administration in Nigeria. Had Horneman not succumbed to dysentery or fever, he would certainly have attempted to follow the great river to its outlet in the sea, and might thus have forestalled by something like fifty years the ultimate discovery of Richard Lander. Major Houghton was sent by the Association to the Gambia. He reached the Upper Niger from this direction, the country of Bambuk, and the Upper Senegal, but was misled by Moorish tribes into entering the Desert, where he was finally killed or left to die.

All this time, though no European had yet returned to tell of actual vision of the Niger waters, there was no doubt whatever in the mind of educated Europe that Western Africa did possess a mighty water-course, rising somewhere behind the mountains of Senegambia and flowing eastwards. What became of the river then was a matter of much disputed conjecture. Some geographers held that it ended in Lake Chad, a great inland sea of Central Africa which had no outlet. Others believed that the Niger after flowing past Timbuktu took a southern bend (which was quite true) and flowing down through the Equatorial regions of Western Africa, entered the sea under the name of Congo. This was the theory favoured by Mungo Park, and one which was not completely disproved till the journey of Richard and John Lander in 1832 finally solved all doubt by proving the Niger to possess about fifteen outlets into the Bight of Benin.

When Major Houghton had disappeared, the African Society looked about for another explorer to search for and relieve Houghton, and if necessary to continue his task. Their choice fell, through the influence of Sir Joseph Banks, on a young Scottish surgeon, Mungo Park, who was born at Foulshiels, four and a half miles from Selkirk, on the 10th of September 1771. He was, as you know, the seventh child of a family of thirteen; his father, Thomas Park, being a small farmer, who, after

the manner of his class and country, determined to give all his children the best possible education. Fortunately, perhaps, for the fulfilment of his desire, Fate or Providence thinned out the family of thirteen to eight. Mungo, in common with most of his brothers and sisters, was first educated at home by a teacher, and then transferred to the Selkirk Grammar School, to which he walked backwards and forwards most days in the week—a distance of nine miles. At fifteen years of age he became apprenticed to Dr. Thomas Anderson, a surgeon in Selkirk, whose descendants, I believe, are amongst Selkirk's citizens at the present day.

In 1789 Mungo Park entered the Edinburgh University to complete his medical studies, during which time he gave special attention to botany. This taste had a decisive effect on his career, for it brought him into close relations with a clever young gardener and botanical student, James Dickson, who married one of Park's sisters. Dickson came to know Sir Joseph Banks, who had himself given Dickson a botanical appointment in London. Through Sir Joseph Banks' influence Park was appointed surgeon to an East India Company's ship, and under these auspices Park accomplished a sufficiently noteworthy voyage to Sumatra and other parts of the East Indies, where he made collections of Natural History. On his return, when he was twenty-four years of age, through the influence of Sir Joseph Banks he was selected by the African Association alluded to already.

On the 21st of June 1795 he landed at the mouth of the Gambia, where he was obliged to remain until the beginning of October. On the 2nd of December in the same year he left the navigable regions of the Upper Gambia and directed his little caravan toward the Upper Senegal. Between the Faleme and the main Senegal River, however, he met with almost insuperable difficulties. His goods were plundered, his followers dispersed, and he was reduced almost to death by starvation till he was pitied and relieved by an old woman. At this juncture also there came on the scene the son of a great Mandingo chief of the Upper Senegal, who, thinking that his father might like to see a real white man, took Park along with him to his father, the King of Kason, whose country lay round about the modern French station of Kayés. From this point the Senegal is navigable almost all the year round to the sea. This, in fact, was the country of Bambuk which has always played an important part in West African history. From here he made his way to Kaarta, still in the land of Negroes, though a region bordering on the Sahara. Consciously or unconsciously, he was following the same route as Houghton. Although longing to proceed due east and strike the Niger, native wars and rumours of wars kept heading him off in the direction of the Sahara Desert and the land of the Moors. These Moors were distinctly different to the Tamasheq (Tawareq) of the more central parts of the Sahara, who founded Timbuktu in the eleventh century, and who ever since have been intermittent raiders of the northern bend of the Niger. The "Moors" who are to be met with along the north bank of the Senegal and in the western limits of the Sahara Desert are allied in origin to the Tawareq, but are a good deal more mixed with Negro

and Arab blood. Some of them speak the Zenaga dialect of that great group of Berber tongues which includes the language of the Tamasheq (Tawareq or Touareg) also. But a debased form of Arabic ("Hassanieh") more ordinarily prevails amongst them. The Sultan of Ludamar was the chief of a section of these Moorish tribes, and a man probably of mainly Arab descent. He enticed Park and his two remaining servants, Johnson and Demba, into his possession. Between February and June 1796 Mungo Park was treated like a mouse captured by a cat. The detestable Arab-Moorish hybrids, sometimes known as the Hassanieh tribe, submitted him to every indignity and considerable torture. Again



The Niger Basin.

and again they were within an inch of killing him. Sometimes he would be allowed a deceptive amount of personal liberty, so that he would escape and perhaps travel a hundred miles or so from their clutches, only however to be captured, brought back, and worse treated than ever. He was robbed little by little of his possessions. Once, he tells us, he was shut up in a hut with a wild hog, any species of pig appearing to these fanatical Muhammadans to be the vilest of animals, and consequently to have a natural affinity with Christians. Strange to say, however, the pig did not attack Park, but frequently charged and gored his tormentors. His faithful personal attendant, Demba, was sold into slavery, and never heard of any more. The other, an Anglicised Negro named Johnson,

worn out with constant terror and privations, lost all hope, and refused at the last moment to accompany Mungo Park on his second attempt at escape. Park during his captivity would have died several times from sheer starvation had he not been taken pity on by some of the Moorish women, especially by a certain Fatima, the wife of his principal tormentor, Ali. Fatima was a mountain of flesh, as are all the high-caste women in the harems of these Moors. She took a capricious liking to Park from his good looks, which were apparent even when he was emaciated with hunger and fatigue. Indeed, through all these adventures in Africa women befriended him, old and young alike. Generally at some crisis a woman provided him with food or shelter. Yet it is amusing to read that the Moors, women and men alike, reproached Park with being grossly indecent, because he wore the European clothes which were fashionable at the end of the eighteenth and beginning of the nineteenth centuries. Though these persons were almost without an elementary idea of morality—were even, one might say, depraved—they considered that the human form should be as little revealed as possible, and shrouded in voluminous garments. It is perhaps somewhat extraordinary that Mungo Park, like several other African explorers of the same date, in the North as well as in the tropical regions, clung so tenaciously to European clothing, obviously unfitted as the fashions of that day were for African travel, besides the fact that they made the white man at once conspicuous; whereas clad in Arab or Moorish fashion he might have passed through these regions without undue notice or opposition.

When in the month of February 1796, Park left the Moorish camp before the dawn, jumped on to a horse, and galloped for freedom, he had embarked upon the most critical period of his life until that last struggle with the rapids of the Lower Niger which terminated his existence. He had to ride from the verge of the Sahara through the Negro country of Bambara. Much of the northern part of this country was waterless. Park was sometimes five days at a time without a drink of water, which he then only obtained from some chance rainfall. There was fortunately a certain amount of herbage which kept his horse alive, and he himself would assuage the agonies of thirst by chewing leaves. As often as not the storms which seemed to promise relief were only dust storms, and added to his agonies of thirst. Occasionally he would be unable to approach a well or a stream-bed because the way to the water-supply was obstructed or guarded by fierce lions. The journey was by no means devoid of human beings, but from none of these did he derive anything but harsh treatment. Much of the country had to be accomplished on foot, the horse being too weak to bear him. If his resistance to the agonies of thirst is wonderful, it strikes the reader of his experiences how more remarkable was that bodily strength which enabled him to exist, walking or riding, for a week or ten days at a time with practically no more food than could be derived from the chewing of leaves or roots, or an occasional handful of beans tossed to him by some half-contemptuous Negro.

But at last he got near to the Bambara capital of Segu, and to his great

relief his reception at the hands of the Negro king was a friendly one, though the king, influenced by Moorish visitors at his court, refused to see Park personally. It was when waiting to cross the Niger at Segou, "shunned and treated like a pariah," that he received unexpected hospitality and kindness from a negress, who, while he rested, sang with her companions that song which Park inscribed in his book, and which has been so often quoted :—

"The winds roared and the rains fell.
The poor white man sat under our tree.
He has no mother to bring him milk,
No wife to grind his corn.
Let us pity the white man ;
No mother has he."

From Segou, Park travelled along the north bank of the Niger to Sansandig, where he was again harassed by the detestable Moors. His journey extended along the Niger banks for another eighty miles eastwards; but he stopped short before reaching Lake Debo owing to the utter destitution of his condition and the hostility of the Moorish merchants (whose denunciation of him dissuaded the Negroes and Fulas from showing him hospitality). His clothes were reduced to rags. He had absolutely no means with which to buy food, having parted even with the brass buttons of his coat in return for such hospitality as had been shown him. Amongst the tortures he endured at that time were mosquito bites. The whole valley of the Niger was swarming with mosquitoes, and every night was renewed misery. How under these conditions—alone, half-naked, and absolutely without means—he ever succeeded in returning to the coast, is one of the marvels of African exploration.

For some time past he had been without his faithful horse, which he had left behind in an emaciated condition at a place called Madibu. After returning on foot from his furthest exploration of the Niger, and again at the point of despair, having been very badly treated by a Negro guide, he raised his voice in expostulation in the streets of this town of Madibu, and to his surprise was answered by the loud neighing of a horse. At that moment the head man of the town came up to him and asked if he knew who was speaking to him. Park looked puzzled, and the man explained his jest by saying that the neighing came from Park's own horse which he had left behind, thinking it was dying, which had recovered, and now recognised its master's voice.

But his troubles were far from being over, though it was a great joy to regain possession of the faithful steed. The rains had burst in their fullest violence in the month of August. As he retraced his steps along the Niger banks the Moors renewed their persecution. He was driven from village to village, often without food or shelter, sometimes within an ace of being killed by lions, which in those days seem to have infested this country in extraordinary numbers. Whenever his life was saved by timely food or shelter, it was a Negro who showed this kindness. Moors, Arabs, and Fulas evinced an unwavering hostility towards the white man. Yet it is regrettable to note that Park apparently to the

end of his days could not bring himself to condemn the Slave Trade. The only thing which excited his compassion, in the horrors of which he was one of the principal witnesses, was the fate of the intelligent Muhammadans of the superior, almost Caucasian races—Arab or Fula hybrids—being sent into captivity. For the poor simple-minded black Negro, the one type of humanity that had made his exploration of the Niger possible, he had little to say.

On his return journey he traced the course of the Niger upwards as far as Bammako. Here, curiously enough, the Moors showed themselves very civil, and sent the traveller rice and milk. Leaving Bammako to travel through the Fula country of Manding, Park was set upon by Fula robbers, who stripped him naked, robbing him even of his hat. When he protested they were within an ace of shooting him, but as they rode away, one of the Fulas, more compassionate than the rest, threw back to him his hat, shirt, and trousers. Park was transported with delight, for in the lining of the hat were hidden the precious notes that he had made of his journey. Once again he was rescued by Negroes, and Negroes on his subsequent journey across the mountains towards the Gambia nursed him when he was ill with fever, and kept him as their guest for months till he regained his strength. At last he joined a Muhammadan slave caravan, and under its escort reached the navigable waters of the Gambia, where, of course, he found that he had long since been given up for dead. From the mouth of the Gambia his journey home was still one of ill-luck. He started in a slave ship bound for the United States. The ship was so unseaworthy that it had to put into the island of Antigua in the West Indies. Here, fortunately, he obtained a passage in a fast sailing vessel which landed him at Falmouth on the 22nd of December 1797. He had been absent from England two years and nine months.

Arrived in London, Park devoted himself to writing an account of his travels. He then returned to Foulshields, and spent much of the year 1798 in the vicinity of Selkirk. In the summer of 1799 he married Miss Anderson, the daughter of his old master and teacher, Dr. Anderson. They had a happy married life (during which three children were born), until the close of 1803, when he was invited to visit the Colonial Office in London. Between 1799 and 1803 Park practised as a surgeon at Peebles, but was constantly visited with restless longings to add to his achievements as an explorer. The British Government now offered him the command of an expedition to explore the course of the Niger. He accepted the commission. Various delays occurred in its equipment, but at last, on the 31st of January 1806, he started from England, accompanied by Dr. Anderson and Mr. George Scott, both of them from Selkirk or the vicinity. He also took with him five boat-builders or carpenters. At the island of Goree, which is in the harbour of Dakar (now the capital of French West Africa, but then a British possession), Park picked up Lieutenant Martyn, thirty-five British soldiers, and two bluejackets. With this force, which rode donkeys that had been shipped from the Cape Verde Islands, he ascended the Gambia, and on the 27th of April 1805 set out from the upper navigable reaches of that river in the direction of the Niger. He reached Bammako on the Niger at the

end of August with only *seven* survivors out of the forty Europeans who had started with him from the Gambia. None of these Europeans were of any real aid to Park owing to their inexperience of African travel, their over-indulgence in alcohol, and the extent to which they suffered from fever; but he had with him a Mandingo head-man, Isaac or Izako, who was often of great assistance, and whose ultimate action in regard to Mungo Park probably rescued for us the only evidence we have of his second exploration of the Niger. Alexander Anderson, his brother-in-law, to whom he was devotedly attached, died on the 28th of October 1805, and Scott soon afterwards. Nevertheless, with Lieutenant Martyn and the remaining Europeans (Martyn unfortunately seems to have been a man of very different calibre and usefulness to either Scott or Anderson), Mungo Park left Sansandig on the Upper Niger at the end of November 1805 in a sailing vessel which he had rigged out in preparation for his journey of discovery down the Niger. His crew consisted of Martyn, three British soldiers (one of whom was mad, while the others were sick), Amadi Fatuma (a Mandingo guide), and three Negro slaves.

From the subsequent information collected by Izako from Amadi Fatuma, who was the sole survivor of the expedition, we gather that Park, after leaving Sansandig, journeyed almost uninterruptedly down the course of the Niger as far as Yauri, a place on the Niger some distance to the north of the Bussa rapids. Park's expedition had been attacked by natives near Lake Debo, and again in the vicinity of Timbuktu. At the Tosaye rapids fresh attacks took place on the part of the Tawareq, while the vessel was nearly lost on the rocks with which the river began to be strewn. But after leaving the Ansonga rapids the expedition had a long stretch of uninterrupted navigation, especially when they entered the Hausa country, and therefore Park dismissed his faithful interpreter, Amadi Fatuma, at Yauri, believing that he was now in close proximity to the Gulf of Guinea. Moreover, as from this point southwards he expected to travel through Negro lands, he felt assured of a friendly reception. Unfortunately, Lieutenant Martyn was the worst possible assistant under these circumstances. His one idea seems to have been to shoot at any native gathering of suspicious aspect or intentions. The hostilities increased concurrently with the frightful difficulty of navigating the Bussa rapids. At last the prow of the vessel stuck in the cleft of a rock, and in despair Park and his companions jumped into the water, where they were either drowned or killed by the weapons of the enraged Negroes. Only one boatman (a slave) survived this disaster.

We must not be too severe perhaps even on the memory of Martyn. It must be remembered that the appearance of the white man in the lands of the Niger was a serious portent to the intelligent Fula, to the Arabised Moor, and to the Tawareq of the desert. They already realised that in the Northern Caucasian they themselves saw a future master, one who was going to set their world to rights. Therefore wherever Park went with his expedition they received him with undisguised hostility. The rumour of war spreads easily in Africa, and no doubt long before Park himself arrived within their gates the Negroes of Bussa heard an exaggerated account of the slaughter which was being effected by the

white man's weapons. Nevertheless it was a cruel tragedy which robbed this gallant pioneer of the complete accomplishment of his task.

It was long before his family believed that Park was really dead, despite the fact that the British Government despatched Izako to collect positive evidence, and that Izako even succeeded in bringing back Park's sword-belt from the King of Yauri. As late as the year 1827, Thomas Park, the explorer's second son, seized an opportunity of landing on the Gold Coast, and started for the interior to search for his father. He died or was killed on the borders of Ashanti.

Not even when Izako returned with all the intelligence he could collect as to the fate of Park's expedition was it realised how near the great explorer had been to solving the whole secret of the Niger, that he had died in fact at a spot only some four hundred miles in a direct line from the Gulf of Guinea. The first calculations as to the extent of his exploration only carried the Niger eastwards about a hundred miles beyond Timbuktu. Nevertheless in 1808 a clever German geographer, Reichardt, had published a guess to the effect that the final outlet of the Niger was contained in that huge delta of rivers—in fact, what we now know as the Niger Delta, in the Bight of Benin. Very little notice was taken of this. Nor was there even much attention paid to the still more remarkable deductions of M'Queen. M'Queen was a Scotsman who resided for a time in the West Indies, and there came into contact with Mandingo slaves, one or two of whom had actually known Park on the Niger. For years he collated the accounts given to him by intelligent Negroes in the West Indies, and in 1816, and again in 1821, he published theories as to the course of the Niger and its outlet into the Bight of Benin which traced its course with astonishing accuracy. Nevertheless a considerable volume of scientific opinion held that the Niger could not cut its way through the continuous range of the Kong Mountains, which theorists had drawn all round the West African coast-belt. The theory that the Niger was lost in the wastes of the Sahara was too disappointing to be entertained. Consequently the *Congo* was considered its only possible outlet, and Captain Tuckey was sent out by the British Government to the mouth of the Congo to trace that river up till it ended in Mungo Park's Niger. His expedition was a complete disaster.

Then a new way of approaching the Niger regions was suggested, and Denham and Clapperton and Oudney were despatched by the British Government from Tripoli to cross the Sahara. This they did with extraordinary success. They discovered Lake Chad and the Shari River, and finally Clapperton reached the vicinity of the Niger at Sokoto. But the Fula sultan would not allow him to continue his journey to the great river. He therefore returned to England, and was again despatched to West Africa. Amongst his companions, all of whom soon died after leaving the Gulf of Benin, was Richard Lander, a Cornishman. Clapperton and Lander passed through Yoruba, and reached the Niger almost at the exact spot where Park had been killed. Clapperton then proceeded by a devious course to Sokoto, where he died of fever. His faithful companion, Lander, returned to England. Under discouraging

circumstances, and with very paltry encouragement from the British Government, Richard Lander with his brother John went out again to West Africa, landed at Badagry, a place near Lagos, and thence reached Yauri on the Niger. The brothers Lander navigated the river down stream till its junction with the Benue, and thence southwards into the fierce Pagan cannibal country of the Lower Niger and its delta. After overcoming tremendous difficulties, they issued from the main stream of the Niger through the Brass River to the breakers of the Atlantic Ocean. They had completed Mungo Park's exploration down to the sea.

There then only remained to trace the main stream of the Niger to its source. The sources of the Niger were perhaps actually discovered by two French explorers, Zweifel and Moustier, and by the English traveller, Winwood Rede, in the sixties of the nineteenth century.

The ultimate history of Niger exploration has been a division of glories between Britain and France, with some share also to be attributed to the eminent German, Flegel. The region drained by this great river is partly under French and partly under British administration. The great names—so far as Britain is concerned—in this work are also Scottish in descent, if not always in birthplace. Amongst them must be mentioned MacGregor Laird, who practically founded the British navigation of the Lower Niger, and that fleet of trading vessels now belonging to Messrs. Elder Dempster, with its shipbuilding yards at Glasgow; Joseph Thomson, who made the most important treaties that extended British influence over Northern Nigeria (and who has written an admirable *Life of Mungo Park*); and Sir George Taubman Goldie, whose family, I believe, originated not far from Selkirk, who was the political founder of the British dominions of vast extent which lie between the Niger, the Benue and Lake Chad. Perhaps also I may venture to attach my own name with due humility to the long list of "Nigerians," as also being one of Scottish descent, for to your lecturer of to-night fell the lot of organising the beginnings of the British Protectorate of Southern Nigeria, in that Delta of the river which Mungo Park very nearly succeeded in tracing to its outlet in the ocean: that river with which his name must remain for ever connected, like that of Speke with the Nile, Stanley with the Congo, and Livingstone with the Zambezi.

ON THE FRONTIER OF THE WESTERN SHIRÉ, BRITISH CENTRAL AFRICA.

(*With Map.*)

By H. CRAWFORD ANGUS.

THOUGH the boundaries of the Western Shiré have been defined upon the map, and several of the more important rivers and mountains have been approximately denoted, yet very little seems to be even yet known

of the country through which the frontier line passes, and several errors are apparent in the course of rivers, the position of mountains, and names of places, on the latest maps, which facts lead me to conclude that, though the country has been roughly triangulated, no more detailed survey has been executed, the significant words "from native information" being often noticed on recent surveys.

Having lived in that portion of Central Africa for nearly two years, engaged in hunting and trading, I acquired a very intimate knowledge of its geographical features, and it is therefore my purpose, while describing the lesser characters of this frontier country, to point out some of the omissions and errors which are noticeable in the current maps of that locality.

At the time that I first penetrated into this district, it was practically unknown, and, as far as I could ascertain, I was the first European who had ever travelled in that region. None of the chiefs, and hardly any of the inhabitants, had ever seen a white man, and no intercourse was held with the neighbouring tribes. There were no routes or paths leading to the country, and the only way of reaching it was to travel through the jungle.

There were several reasons for this state of things, the chief of which were the evil reputation which the inhabitants had acquired from their warlike habits and their use of poison, which facts caused trading caravans to avoid the district and proceed to the Zambezi or Shiré by other routes, and the constant warfare in which the inhabitants were engaged with the Angoni in the North, the Makololo in the South Shiré districts, and the Portuguese and their ally Chinsinga in the Zambezi districts north of Tete. This state of war was responsible for the absence of the ordinary native paths, which in that country act as means of intercommunication, the people being in the habit of avoiding making defined tracks through the jungle in order that their enemies might have no clue to their strongholds. Finally, another cause is the suspicious and turbulent character of the inhabitants themselves. At the time I write of, the Anglo-Portuguese boundary, though laid down in theory, had not yet been defined, and the Central African Administration being elsewhere engaged in "peaceful penetration," had not taken any steps to bring the district on their side of the frontier under their rule, while the Portuguese, on their side, had been powerless to make their rule acknowledged.

These, then, were the reasons to which were due the unexplored state of the district, which is an important district, being the watershed of the Shiré and Zambezi rivers.

The columns of a geographical magazine are not the place to discuss anthropological subjects, but the effect of geographical surroundings has such an important bearing on the lives and customs of the inhabitants that I must permit myself a short reference to them.

There are two tribes inhabiting this country, the one occupying the mountainous region between the Revubwi and Mwanza rivers, and the other the country lying between the Revubwi and the Kapochi. My observations concern mainly the former, who are termed "Azimba,"

and my acquaintance with the latter, termed "Achipeta," was less intimate.

I am very much inclined to think that the origin of these two tribes is different, though some persons have considered them to spring from the same source, but this I do not think likely; and while, so far as I can ascertain, the Azimba are directly descended from the original inhabitants of the country which they at present inhabit, the Achipeta I consider a tribe originally living beyond the Loangwa river, who were forced east by the Zulu emigration northwards under Kazunga-ndawa. Though I have stated that the Achipeta country lies between the Kapochi and Revubwi rivers, yet kindred tribes inhabit all that country beyond the Kapochi as far as the Loangwa, and have their strongholds wherever there is a rocky eminence or mountain. Under various names, as Asenga, Avisa, the country inhabited by them stretches far north, circling round the borders of Northern Angoniland. But the Azimba are only to be found in that small portion of territory bounded by the Shiré on the east, the Revubwi on the west, Central Angoniland on the north, and Makanga country and Mikolongo on the south.

The customs of the two tribes are also distinctly and unmistakably different. Their initiation ceremonies, their funeral and marriage rites, their mode of dress and hair-dressing, their weapons, all differ, and their language and intonation are also so different, that the two people can hardly understand each other.

One important point is, that though the Azimba have knowledge of various poisons which they use for the capture of game and fish, and to mix in the food and water of their enemies, yet they have no knowledge of the poison with which the Achipeta smear their war arrows, and look on the custom with horror. Indeed I have seen them cry out with fear and bolt precipitately on occasions when these arrows have been used against them.

I was at some pains to go into the history of the Azimba tribe during my residence amongst them, and what I gathered I shall relate as briefly as I can.

When I first came in contact with them, I found that they were split into five portions or small clans. The one under Ndifula and his brother inhabited the Mount of Zobwi and Nyamba-chikopa—the place of torn shields, named from a fight which took place there with the Angoni, in which the latter were beaten—and claimed all the country as far as the banks of the Mwanza river on the east and the river Nkombedzi on the west. Another clan, the most powerful, under Kasuza, inhabited Mount Ntapassa, and claimed territory from the banks of the Nkombedzi river as far north as the borders of Angoniland, and as far west as the rear side of Mount Ntapassa, where the country of Mombusa commences, and goes west as far as the Revubwi river, both countries reaching south as far as Mikolongo and Makanga. Further northwest was another chief, Goruza, who claimed from the northern boundary of Mombusa's country to the banks of the river Dwembi northwards; eastwards to Kasuza's boundary, and westwards to the Revubwi; and still further north, beyond

Goruzá's boundary, on the Dwembi, was Matiweri and his mother, Nyangu, the real chief, with boundaries on the Dwembi, the Revubwi, Angoniland, and Kasuza's country.

These were the five clans, and it is interesting to see how a people, once evidently powerful and united, came to be split up into factions always warring with each other.

I may as well give the tribes' history by the mouth of Goruza, the man who related it to me:—

"Long ago we were a powerful people, and all that country you passed through, all across that plain where runs the Nkombedzi, our villages were thick, and instead of trees was all maize fields and millet. In those days the elephants used to come in herds to trample our corn, and we used to kill many, and get much ivory; now there is nothing to fill even one elephant, and I have to catch monkeys and sell their skins to buy powder. But all this was long ago, before I was born, or before my father's father was born. Then we were under one chief, and were strong in war, so that all the people about us gave us peace, and we sold them our ivory for many slaves; now we live like mice in holes, and are harried by every one. Do not the Angoni call us 'the mice that God has given them to kill—Zimbewa za malunga.'

"Along the Mwanza were tobacco fields, and at Chuwali (on the Revubwi) we grew rice, so you may see how big a land we ate up, and right as far as Nsanganu we made new gardens. To-day you can see the marks of our rubbish heaps at the head of the Makurumadzi. Wasn't that a big land to cover? but we covered it as easily as I cover my body with this little piece of bark cloth, which is so old that even the lice cannot hide in it any more, not like the thick cotton cloth the white man has in his tent.

"But all this was swallowed up, washed away like the Nkombedzi in flood washes the dead leaves, when the Angoni came. For first we had trouble with the Achipeta, with whom we used to barter iron and ivory, which they sold to the Arab traders, who came down the Loangwa. For they came to us and wanted to take our land, as they had been beaten in war by a great tribe, whom we did not then know were the Angoni. And they wanted to come into our place, but it is ill making room for a beaten people, as when the lion wounds his prey he follows it and then he kills where he goes. So we refused them, and fought and beat them beyond the Revubwi. For a long time we heard tales of men armed, with the skins of cows and with goats' hair on their heads, but they never troubled us till after I was born. I was born at Zobwi, and my father had all the land down to the Makurumadzi. And then one day the news came that fire had been put to our villages at Nsanganu, and a strong tribe was eating up our people there; but we did not fear, for we did not then know these Angoni. So all our men went out to meet them, and we fought a great fight all from Nsanganu down to Kalangombe.¹

¹ The resting place of oxen—named so from the fact that the Angoni halted there when taking their cattle to Tete; the name is, therefore, evidently subsequent to the Angoni invasion.

"For weeks we fought, but always the Angoni brought up fresh men, and we were compelled to fall back. And so it went on for years, until at last we were driven to the hills, and even then we had to hide in caves, and grow our maize in hollows of the rocks, and many of us were caught and killed, and many made slaves, until very few of us were left. When it came to that—I was a grown man then, and had a wife and a child—we saw that to stay on here was simply to give our bodies to wash the Angoni spears in sport, and Kasuza's father called us all together, and after burning our houses and breaking our pots, we went down and offered submission to Kankuni, the father of Chinsinga, who was a friend of the Portuguese, and owned Makanga country. We had always fought them till then, but now, even though we were a weak people, he wanted us, as we were good hunters, and he knew we would bring him ivory. Also he was at war with the Angoni and needed help. We may have been slaves to go to him, but at least we could carry on our dances and initiations in the proper way; when living like rock rabbits, we could not teach the young girls and boys, and we had only water enough to drink, and none to make the proper ablutions with.

"So we went to him and he gave us welcome for a time, and good came to him from our friendship, for we killed many elephants, and always sent him the ground tusk.¹ But at last a talk arose that we were too strong, and Kankuni's mind began to fear that we might at last come to rule in his land, for our chief Kasuza's father was a wise man, and Kankuni resolved to cut at our strength. So when the first fruit offerings, which are made when the corn is ripe, came round, he called our old people together to do them honour and make a big feast, and they all went, and he gave them much cloth and beer, so that their hearts, which at first shrank from him, turned, and they all praised him; but when night of the second day of the feast was come, he mustered all his own following, and confusing our old people by mixing hemp in their beer, he gave them all to the spears of his people. Young and old, women and children, all suffered; only I, having been warned by Kasuza's mother, fled, taking with me Kasuza and his brothers and mother. That was a great killing, and the shame of it still rests on Kankuni's son Chinsinga. Right northwards I fled with the mother and the sons till I rested at Chuwali, where I found shelter, for the people of Chuwali did not eat from Kankuni's hand because of trouble about a ground tusk, and they lived in too strong a place for Kankuni to come at them.

"Then I being a hunter, left there the mother and her sons, and went to hunt elephants. Much I hunted, and many elephants I killed, but at last I was caught by a party of Angoni; see the marks on my body of the wounds they gave me; and for years they held me a slave, however, treating me well, as I was known for a big hunter. So I lived and was in peace with Chikusi their chief, who gave me wives. But

¹ When an elephant is killed the tusk next the ground when the elephant lies dead is the right of the chief on whose land it was killed.

with one chief I was not friends, for he desired 'ka nyanda nyangu,'¹ whom I had lately acquired. And he being powerful, one day when I was away hunting he took my wife, and Chikusi would not give me redress. So I brooded over this till news reached me that there was a talk of people living in our old land, and I thought of Kasuza and his mother whom I had left at Chuwali, whom I discovered, from fear of Kankuni, had left Chuwali and gone back to the old place. When our people heard of this, gradually one by one they turned to her, and soon villages sprang up on the mountain of Ntapassa, the people preferring to live in war rather than eat the poison of their hosts. So I resolved, too, that I would also go home. But before I left Angoniland, I waited for my revenge upon the man who had stolen my wife; and one day, he being called to Chikusi's village, I gathered my people, for I had a following, and burning the village of my enemy, and taking all his cattle and pots and women I fled south to Ntapassa. That was a big blaze which I made, and when my enemy came back and found the fire in his thatch and all his women gone, he followed me, and we fought on the road, but my people having knowledge of guns beat off the Angoni, whose weapons are the spear; and whereas in olden times an arrow could not pierce a shield, a bullet now goes clean through it and hits the man behind. So I came to Ntapassa and found Kasuza and his mother, but even then there was no peace, for many small headmen arose each wanting power, and one climbed into that hill and said, 'I am a chief'—a chief of what, of rock rabbits—and another into that hill, and all quarrelled about gardens and ground tusks, as if the Angoni were not at our doors. And now you see how we are, with fire all round us (Fire is a polite term for war). In the north are the Angoni, but with them since the fight at Nyamba-Chikopa, where we beat them and gathered a heap of shields, so high, we have had very little trouble. In the south are the Portuguese, who want us to eat Chinsinga's grain, he whose father killed us like rats. In the south-east to Mikolongo are the Makololo, who want our country; and in the west the Achipeta, who use poison on their arrows and who know no decency. And now our only hope is that the white man will give us peace, and then our gardens will stretch to Nsangnu again, for we bear many children, at present food for spears."

Many other stories the old man told me of the past glory of the tribe, and it was easy to see from their customs and ceremonies that they had once been an important people. Many degradations had, however, from necessity of their changed mode of life, crept into their ceremonies, such as the use of clay instead of water for certain ablutions, due to a scarcity of water in the caves where they lived, and immoral relations due to a scarcity of womenkind; the structure of their dwellings, and their mode of life, also deteriorated by their confinement to the hills. When not at war with their neighbours they were always fighting amongst themselves, and killings were of daily occurrence. Poison was freely

¹ A domestic term for a wife, only used in Azimbaland, literally "my little piece of bark cloth," derived from the phrase applied to a wife, "the little piece of bark cloth that keeps my back warm," from the fact that the man lies next the fire in the hut, his wife sleeping at his back between him and the wall.

used to get rid of an enemy, and slaves were harshly treated and given no benefit from the slave laws that usually govern their existence. During my stay with this people I gained their confidence to a large extent and managed to put a stop to the Angoni raids which harassed them, so that before I left them they had to a certain extent left the hills and begun to cultivate the plains again. They also evinced more cohesion among themselves, and many matters over which they used formerly to fight were referred to a council of chiefs for settlement. I have, however, though the history of the tribe and a description of their customs would fill no small volume, already devoted too much space to this subject, and I will now turn to the geographical features of the country and the errors which I have noticed in the current maps of that district.

In a map by Mr. Daniel Rankin, made in 1892, his route is marked as passing through part of the country I refer to, but as none of the chief mountains or rivers are marked, and some places now definitely fixed are erroneously located by him, I am inclined to think that he passed south of Azimbaland, and that his route was not so far north as he has placed it on his map. He evidently did not cross the Makuramadzi, and only followed the Mwanza up a little above Mikolongo.

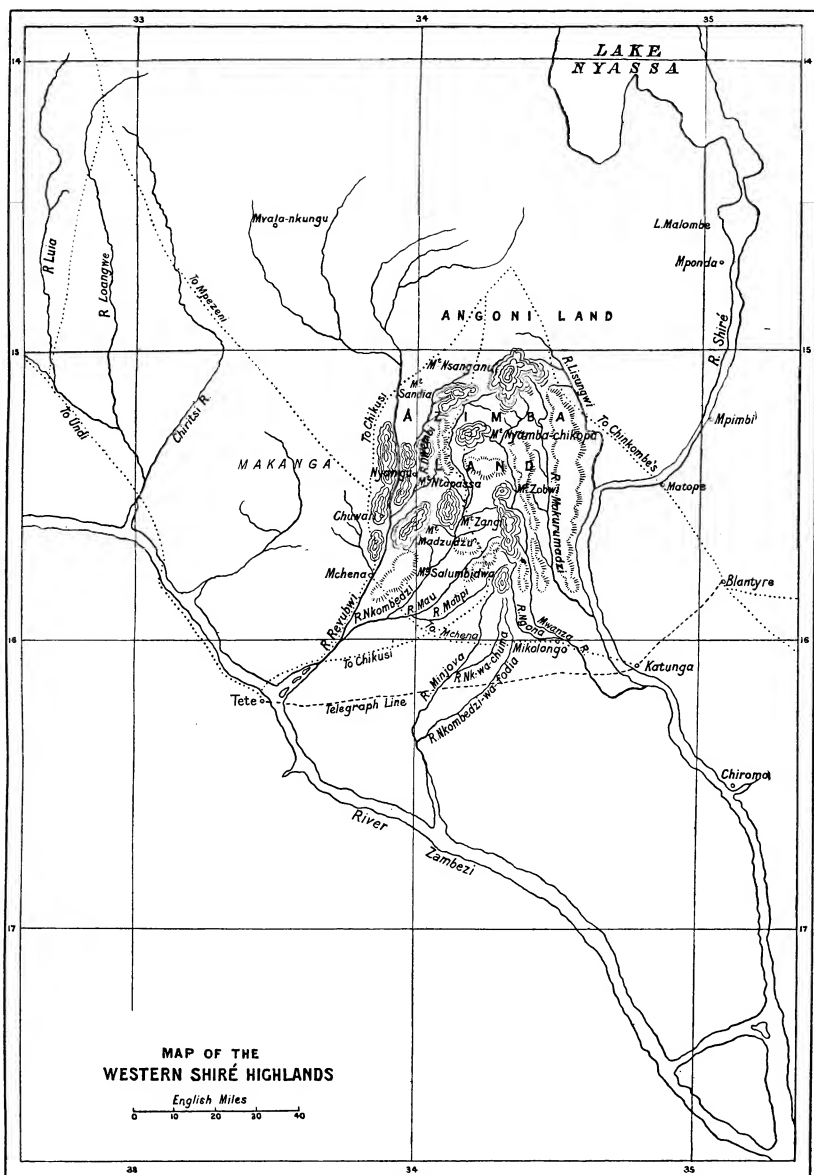
To turn first of all to the trade routes and means of intercommunication in and surrounding that district :

On the east there is the Shiré river, impassable at that portion on account of the Murchison cataracts, and thus the route to the north from Chinde and the sea lies *viâ* Blantyre to Matope on the Upper Shiré. The Shiré river makes a wide circle between Matope and Katunga, the landing place for Blantyre and the north, the greater portion of which circle is broken by rapids. This route *viâ* Blantyre is the only route to the north on the east side.

From Matope and Mpimbi higher up the Upper Shiré there are several well-defined paths leading to Northern and Central Angoniland, and the southernmost path of all, the one leading from Matope to Chinkombe's in Central Angoniland may be taken as the northernmost boundary of Azimbaland.

On the south a well defined track from Katunga on the Lower Shiré to M'chéna, marked Muchéna on Rankin's map—M'chéna means "white" or "whiteness"; Muchéna would mean "in whiteness"—*viâ* Mikolongo on the Mwanza, forms a rough boundary between the Azimba and their southern neighbours, though the villages of the tribe are many miles north of this.

On the west a fairly well beaten path leads from Tete to Makanga, M'chéna, and Central and Northern Angoniland, keeping, however, west of the Revubwi river and avoiding the boundaries of Azimbaland, and after leaving M'chéna passing through Achipetaland. Still further west there are two more routes, both starting north from the Karoabassa rapids on the Zambezi, the one crossing the Kapochi, Luia, Loangwa and Chiritsi rivers, and leading to northern Angoniland and the lake, and the others, following the Kapochi to Undi, and from thence proceeding north to the Loangwa river. It is this last route which is followed by the Arab trading caravans coming down to Tete and the coast from



Bangweolo and Tanganyika. Between this route and the Revubwi river, which is the boundary of the Azimba, the country is hilly, covered with a low "Masuko" scrub and badly watered. There are few hills of any size until Chuwali on the banks of the Revubwi is reached, and the country is cut up by numerous dry ravines and barren gorges. The few hills and prominences which are scattered over the face of the land are inhabited by the Achipeta, who live in a state of constant warfare and whose hostile attitude to strangers causes them to be avoided. I had some dealings with them, not always of a friendly nature, and found their customs repulsive and their standard of life and morals very low.

It will thus be seen that Azimbaland is comparatively isolated from the surrounding country, none of the big trade routes passing through it. The only route traceable, which at one time traversed the country, and which is now hardly distinguishable, is that leading from Tete to Central Angoniland. This route, evidently at one time of importance, runs from Tete to Mount Salumbidwa, and skirting the western slopes of that mountain heads north until the Nkombedzi river is reached, then follows the Nkombedzi north to almost its source near Mount Nsanganu, to a slope which Mr. Rankin has marked as the Bondeka mountains, but before reaching this point the path turns off and cuts over to the Dwembi river, a tributary of the Revubwi, which it crosses and enters Central Angoniland. This route, now disused, was made by the Angoni in driving their cattle to Tete for sale, and must have been followed and regularly traversed in the early days of the Angoni-Zulu invasion, but since their power weakened has been neglected through fear of the Azimba, who used to attack and cut up the caravans.

Inter-communication between the villages of this district is infrequent, intercourse being held between them by means of elephant and game paths. There is no path, connected with any of the aforementioned trade-routes, leading to the country, and the only way of reaching it is to steer a course through the bush. To approach the country from the Shiré the best way is to leave the river at the Murchison Falls and follow the Makurumadzi river until it turns northwards, and from this point it is a distance of not more than ten miles to the Mwanza river, which is found running parallel to the Makurumadzi. The country traversed is very broken, the soil being a reddish brown, interspersed with quartz veins and quantities of schist. A gradual rise over a series of low ridges takes place after leaving the Shiré river until the highest point between the Marurungwi mountain and the Shiré is reached, which is the dividing ridge between the Mwanza and Makurumadzi rivers. The whole of this country is covered with a low bushy scrub, mingled with huge baobab trees, and is very sterile, only the banks of the rivers being at all well wooded or possessing any luxuriant vegetation. From the dividing ridge between the two rivers country of the same nature can be seen stretching away north and south, the formation running in ridges parallel with the course of the river, *i.e.*, north and south. To the west the peak of Mount Zobwi begins to be visible, and the shoulder of a long low mountain a little to the south of it named Zangi, the

eastern slope of which is washed by the Mwanza river, which continues its course right northwards, and does not rise at Mount Zangi as mapped by Mr. Rankin. Leaving the banks of the Mwanza river the country rises more sharply, and the low scrub gives place to forests of well-grown "Masuko" with luxuriant foliage, which tree provides the bark cloth universally worn throughout this district.

The gradual upward ascent ends abruptly in a broad well-wooded plateau twenty miles in breadth, which is mapped under the name of the Marurungwi range, at the portion I refer to, and further north as the Kirke mountains. But it is in reality two distinct ranges divided by the plateau. Mount Zangi, Mount Zobwi, and Mount Nyamba-chikopa are the only hills of any prominence on the eastern side—the side nearest the Shiré. Neither are they continuous, being isolated and separated from each other by broad plains and deep gorges.

None of the three mountains gives birth to any stream of importance, though several small burns find their source on their slopes, and all run to join the Mwanza river.

On the other side of the plateau the character of the range is very different, being much more rugged and precipitous, but even here there are only two mountains of any prominence. The first of these is Mount Ntapassa, and the second Mount Madzudzu, which both rise to a great height above the plain, and are scarped and terraced for hundreds of feet. Mount Madzudzu, which is the stronghold of Mombusa, lies a little to the south and rear of Ntapassa, Kasuza's seat, which faces the plateau.

Further west the country descends to the Revubwi river in a series of well-defined rolling shoulders and dales, much more prominent than the approach on the eastern side of the plateau, and to the north and south merges into a compact mass of low rounded hills, well-wooded, which gradually descend to join, in the north, the open plains of Angoniland, and in the south the barren country stretching to the Zambezi.

The whole distance between the Mwanza and the Revubwi rivers is about fifty miles, the plateau being about twenty miles in breadth, and the two confining ranges and the ascents to them accounting for the remaining thirty miles.

Between the two ranges, but nearer the western than the eastern one, runs the river Nkombedzi, a tributary of the Revubwi river, and this is the only stream of importance which traverses the plateau. The river Minjova, finding its source on the southern slopes of Mount Zangi far south of Mount Zobwi, and the Lisamodzi river which rises at Nyamba-chikopa and joins the Nkombedzi, are at this point dry except during the rains. The Nkombedzi and the Minjova being tributaries of the Zambezi, it will be seen that the eastern range confining the plateau is the true division between the watersheds of the Shiré and Zambezi, all the streams rising in the western range on the slopes of Makzudzu and Mount Ntapassa running to swell the waters of the Zambezi either through the medium of the Nkombedzi or the Revubwi. Mount Ntapassa gives birth to several strong burns, all of which go to join the Nkombedzi, on the other hand those streams rising

on the slopes of Madzudzu mountain all seek the Revubwi river. It will be seen from the foregoing description that this plateau running north and south is confined by two ranges, the one of which is bounded by a tributary of the Shiré, and the other by a tributary of the Zambezi, and the plateau itself is traversed by the Nkombedzi, a sub-tributary of the Zambezi, and that north and south both ranges flatten out to merge into the rolling plains from which they rise. The plateau is thickly wooded with Masuko, but in the vicinity of Mount Zobwi and Mount Ntapassa is badly watered, and it is not till its more northern portion is reached that the many small burns, which intersect it and run to join the Dwembi river, are crossed.

Seen from the plateau Mount Ntapassa has a very striking appearance, the slopes of the foot-hills rising gradually to the foot of the first precipitous upward leap, and then follows leap on leap of black slimy rock till the ragged edge of the summit stands out against the skyline. The mountain in length is about five miles from end to end, and has a basal breadth of nearly three miles. Behind it, a little to the south, Madzudzu mountain raises a round capped head, as distinct from the flat irregular-shaped summit of Ntapassa, and to the north the low hills pile themselves one on to the other till they fade into the distance. These foot-hills are much intersected by small burns which feed the Revubwi river on the one side and the Nkombedzi on the other, though the greater number flow into the former river.

The descent from Mount Ntapassa to the foot-hills about the Revubwi is very sudden, the ravines between the low long parallel ridges being precipitous in nature; and thus the journey from Ntapassa to the Revubwi is a tiresome one, many steep ascents and descents having to be accomplished, as the dividing ridges run north and south.

But to give a detailed description of this district it will be better if I begin at where I consider the mountainous region commences, a little north of Mikolongo, and work north to its termination at Nsanganu, describing as I go along the chief characters of the country and the points on which I differ from the originators of the existing map.

But first it must be understood that from Mikolongo in the south a gradual rise of the whole plateau takes place till an elevation of 6093 feet is attained at the northern termination at Mount Nsanganu, whence the country again falls to the plain of Angoniland; also it must be understood that this district is not of a continuously mountainous character throughout its extent, but that the upward ascent is very gradual, almost imperceptible, and is composed of low ridges and gentle slopes amid which there are only a very few hills of any prominence, and they, from the unprominent nature of the surrounding country, seem to rise abruptly from the ascending plateau.

Mount Salumbidwa is really the commencement of the range, and is situated as mapped a little to the north and west of Mikolongo on the Mwanza. Here the Minjova, a river which joins the Zambezi at the Lupata gorge, finds its source, and two small tributaries of the Minjova also rise here, but one, the largest of all, circles round the western slope of Salumbidwa and runs north to Mount Zangi. But I am of the

opinion, as I have already stated, that this tributary, marked Nkombedzi-wa-chuma, is really the true stream of the Minjova. Further west runs the Nkombedzi, and on the east further north a few isolated hills rise from the ascending country commencing the broken chain of the watershed. Several small streams, dry except in the rains, find their source in these hills and traverse the plateau to join the Nkombedzi. Further east beyond these hills, in the broken country lying between them and the Shiré, the Ngona and the Mwanza, the former a tributary of the latter, run parallel to each other, and continue thus till the Ngona turns west to its source on the eastern slopes of the plateau at Mount Zangi, mapped as Mount Tambani, the Mwanza continuing its course due north and receiving several small burns from the eastern portion of the plateau. These burns are all of a perennial nature, and thus the Mwanza never fails in its supply of water.

On the western side of the plateau the range leading to Madzudzu and Mount Ntapassa now commences to distinguish itself from the prevailing character of the country, but it is not until opposite to Mount Zangi that the western range attains any prominence, and here Mount Madzudzu is the first height of any importance, after which, further north and east, comes Mount Ntapassa.

On the current map several fair sized streams are given as traversing this plain, running from the slopes of the eastern range to join the Nkombedzi, but none of them are of importance and most of them are dry in the summer months.

Still proceeding north and following the course of the Nkombedzi river, mapped as the Nkondodzi river, the country assumes a more broken character, on the western side falling in a jumble of low wooded hills to the Revubwi river, and on the eastern side still bounded by the Mwanza, to which the country falls steeply. The only hill in this latitude on the eastern side, of any importance, is Mount Nyambachikopa.

The plateau narrows here considerably, and at this point the Nkombedzi begins to flow from the north-west, considerably diminishing the distance between itself and the Mwanza river, a rugged ridge or backbone dividing the two rivers. At the same time further east the Makurumadzi is still pursuing its southern course, flowing parallel with the Mwanza, and divided from it by a similar backbone. Makurumadzi means "big water," and further west of the Nkombedzi the Dwembi is, behind a similar ridge, continuing the like southern course. It is at this portion that there is an error in the present map, the Mwanza being mapped as having its source in this dividing ridge, whereas, though one or two dry ravines join it from hereabouts, the true Mwanza still continues to flow from the northward and finds its source in the conglomeration of low hills and ridges out of which Mount Nsanganu rises. Here also amid these hills, on various portions of these slopes, rise the Makurumadzi river and the Lisungwi; there being thus three important rivers, all tributaries of the Shiré, rising from the north-east, east and south-eastern slopes, and two important tributaries of the Zambezi rising from the north-west and southern slopes, these rivers

being the Nkombedzi and the Dwembi, both of which flow directly into the Revubwi river, the former near M'chéna, and the latter at Chuwali.

There is not ten miles distance between the source of any of these rivers. The Nkombedzi, the Lisungwi, and the Dwembi rise all within five miles of each other, and the Makurumadzi and Mwanza a little further south; and though different names can be given to the sources, Nsanganu Mount is really the head of their watershed.

This is practically the termination of the plateau, and though beyond this point the elevation is still above that of the country lying to east and west, the country is open and unconfined by any definite chain of hills, and the descent to the Revubwi, which continues its course past Nsanganu and rises far to the north, is very gradual.

The features of all these streams are very much the same; none of them have high banks, and the valleys of the Mwanza, Ngona, and Makurumadzi are very narrow, with hardly any breadth of bottom. The banks of the Nkombedzi are much flatter and being unconfined in a valley its current inundates a certain amount of land on either bank when the river is in flood. The vegetation on the banks of all these streams is similar; on the Mwanza and the Nkombedzi the raphia palm grows in great profusion. Bamboo of any size is however scarce, the bamboo thickets which clothe the mountain slopes being of a stunted nature.

Of all these rivers the Dwembi is the most interesting, as at part of its course it passes through a series of caves. I cannot be quite certain whether it is the Dwembi itself or a tributary which runs underground, as I have no means of refreshing my memory.

These caves are of a fair size and are all inhabited, stores of grain being kept there, together with sheep and goats. There are two underground channels, an upper one through which the river seems to have flowed at one time, and a lower one into which it now seems to have subsided.

The country traversed by the Dwembi is very fertile, far more so than any other I have travelled through, the banks of the river being very flat and the bottoms of the valleys being broad and open. The soil is rich, and maize, rice, cotton and tobacco flourish luxuriantly. The natural vegetation is also very profuse, bamboos growing to an enormous girth and forming large thickets low down on the bases of the hills.

The altitude of the Dwembi valley is much beneath the plateau, and nearly on the same level as the Revubwi, of which it is a tributary, and which runs parallel to it a little further west for a great part of its course. There is a certain amount of rubber on the hills in this locality, and at Chuwali, where the Dwembi joins the Revubwi there is a considerable forest of it, the Achipeta inhabiting the mountain of Chuwali doing a fair commerce in rubber and monkey skins. These monkeys are of great beauty, and their skins are much prized by the Angoni for making their war costumes. Leopards also abound hereabouts, and the natives trap great numbers of them in log falls.

Before I close I would like to refer once more to the characteristics of the Azimba and Achipeta. The former are extremely dark, their skins being thin and of a soft, easily manipulated texture. The majority of the men and women are tall and handsome, thin-lipped and aquiline in feature. They are very long-limbed, active and graceful in their movements, long trunked and slender fingered and toed, the second and third toes being unusually long and not, as I have observed (whether it may be an anthropological fact or not I am unaware), like the hill and cave dwellers of Achipetaland, whose big toes are abnormally spatulated, and whose other toes and fingers are thick and stumpy. The Achipeta are much thicker-skinned, and their colour is not such a deep black, being more a dark, dirty brown. The hair of the Achipeta also is not so dark as that of the Azimba, being browner in colour, whereas the hair of the Azimba is jet black.

The males of the Azimba tribe wear their hair long and unplaited, whereas the Achipeta plait their hair and smear it with red clay and white flour.

Some years ago I described the initiation ceremony for girls in a paper I contributed to the German Anthropological Society, I being the first European who ever witnessed this ceremony, which was held under my protection in the open plains for the first time for many years; Angoni raids formerly having deterred the people from venturing from the safety of the hills. The Achipeta ceremony is a very different one, and far more degraded, but I cannot enter into such subjects in the columns of a geographical magazine; and it must suffice that the customs of the two people are very different, the Achipeta dances and initiations being much more complicated, and to Europeans indecorous, though to the anthropologist they afford much new information and have many points of interest.

Of the two tribes, the Achipeta are the more turbulent and treacherous, though not so courageous or warlike as the Azimba. The former are quick to attack unsuspecting strangers, while the latter are hospitable and frank. Of this latter fact I had experience during my travels in Achipetaland, when one evening, having taken up my quarters in the vicinity of one of the Achipeta rock dwellings, I was alarmed by my headman coming to me and telling me that the inhabitants were disposed to attack us, one of their number (though I had been on friendly terms with them for some days) having, after exciting himself with a decoction of hemp, climbed on to a rock with a sheaf of poisoned arrows and commenced to threaten my camp. When I approached the scene I found the man at the distance of about one hundred yards standing on a rock with his bow bent and the arrow pointed at us. He was shouting at the top of his voice in a peculiar sing-song tone. "Na-penya-ulendo—na-penya-ulendo"—"I see strangers," though his cry could not be called parliamentary in any sense, "Lassa-ni-ulembi"—"Lassa-ni-ulembi"—"Wound them with poison, wound them with poison." I recognised that hemp was the cause of his conduct, and not wishing to have to shoot him, as I wanted no trouble with the villagers, I called up his chief, who said he was powerless to control him, and that the best thing

we could do would be to bolt. But this would have been only to incite him to actually attack us, and in the end I decided to wait till dark and then try and capture him. This we effected, getting round him under cover of dusk; though it was not a pleasant wait, literally under fire the whole time; of course had he actually shot an arrow at us I would have had to shoot him to save my men, who were so alarmed that I discovered afterwards that they had all gone quietly and made an offering to their guardian spirit, the offering taking the form of pulling leaves off a tree and laying them in a heap, each man contributing; the action being accompanied by the usual hand clapping and supplications.

This will show how untrustworthy the character of the Achipeta is; in comparison to the Azimba, who once formed a fair sized force and came over 150 miles to my aid when they heard that I was in a tight corner, far over in North Achipetaland.

Another difference between the two people is their mode of dwelling, the Achipeta fortifying all their villages with stockades or mud walls, no matter even if they are living in the recesses of the hills, and the Azimba having no fortified place throughout the whole extent of their country.

In concluding this article I wish to state that in trying to describe the district I have dealt with, while correcting what seem to me to be errors in the current maps, I have rather tried to give a picture that can be understood by the average person than dealt minutely with every feature of mountain and river, and that my observations are not those of the surveyor, but simply those of an ordinary traveller whose knowledge of that district is thorough, having lived and hunted in it, and mapped it in a rough and ready way without such aids as theodolites and plane tables.

THE UPPER ITURI.¹

By J. PENMAN BROWNE, M.E.

(*With Illustrations.*)

As the earlier stages of our journey were over comparatively well-known ground, it may be sufficient to begin the present account at Mahagi, which lies near the shore of Lake Albert Nyanza and almost at the foot of the Luru mountains. We stayed two days here, and on the third morning about 5 A.M. set out north-west to cross the Luru hills, in order to continue our journey to the Ituri forest. We were well up the hills when the sun rose, and witnessed a magnificent sunrise.

After traversing the Luru hills we came to a most beautiful country. From the top of the hills right on to the Ituri forest there are broad rolling plains and fertile valleys, having a plentiful supply of clear, cool water in the many streams that flow through the region, which is in my

¹ The illustrations accompanying this paper are from photographs by Colonel Harrison.

opinion very suitable for the white man's occupation, and would make an ideal stock-raising country.

In addition, the climate is splendid, as can be gathered from the fact that this particular territory lies at an altitude ranging from 3000 feet to 6000 feet above sea-level.

What surprised me very much on the first two days' march from Mahagi was the absence of any living thing. No mammals, except a few domesticated ones in the two large villages we came to, were seen, and no birds, except a species of black-and-white crow seen near the villages also. Walking along for hours without seeing an antelope bound across our path, without seeing a bird flying overhead, began to get monotonous, and we were very glad to see at last the huts and plantations of a chief, Moka by name. Not until the end of our second day's march did we find ourselves out of this "Silent Land," and then, strange to say, we found a district thickly populated, and stranger still, a land teeming with all manner of birds and game. Here the natives turned out in force to welcome us.

We obtained a plentiful supply of sweet potatoes, manioc, bananas, tomatoes, and European potatoes, and large bowls of milk, while many dozens of eggs were offered us freely, as also were sheep, goats, and fowls.

On this route—the Mahagi-Ituri forest route, which at the mountains immediately to the rear of the first-mentioned place attains an altitude of 3500 feet, and gradually rises to 6000 in less than 100 miles—one naturally finds many changes in the vegetation with the change of altitude. For instance, at an altitude of 3000 feet to 4000 feet one finds the people cultivating the ground extensively and depending much upon tropical grain as the chief means of subsistence. Further on, and at a higher altitude, bananas and sweet potatoes form the staple food. At this point, European vegetables thrive remarkably well, and it has been pointed out that European grain might equally do well, and so increase the suitability of the district for the European.

The natives in these parts are peaceable and law-abiding, and seem to be happy and contented under the Belgian rule. It was these same people who tried to hinder Stanley on his journey to relieve Emin Pasha at Dufile, but now, instead of trying to kill the white man, they welcome him and do all in their power to assist him. This was, at least, our experience of them.

Five days' march (nine hours per day) from Mahagi brought us to Irumu. From the latter place (which is to be the headquarters of the Haut Ituri administration) one can hear the dull roar of the river Ituri as it dashes and tumbles over the rocks on its rush to join the mighty Zaire, or Congo River. We set off again after a stay of one day here, and, after a march of five hours, saw the dark forest looming out in the distance. One hour more brought us there, and we saw for the first time a band of that little nomad people, the wandering pigmies of the great Ituri forest. They were singing and dancing in front of the resthouse, and continued doing this for about an hour after our arrival, apparently for our benefit. They were very inquisitive, and did not seem to be quite sure of us,

regarding us with a certain amount of suspicion. However, after giving them a few presents, consisting of cloth and salt and beads, we took a few photos of them and exacted a promise from them that they would return and see us the following morning. Next morning came, but no pigmies. They had all fled into the forest depths, evidently thinking we had some sinister motive in wishing them to return.

My friend, Colonel Harrison, then went off in search of elephants, there being many in the forest here, for we could see traces where they had been during the night, and they could be heard in the distance trumpeting loudly. Taking my rifle and shot gun, I got into the old



FIG. 1.—A Group of Pigmies and Balessé.

canoe, and with two men to paddle I went down the river, intending to look for rubber-bearing vines, and also to try and get a shot at the many bright-coloured birds which were seen flitting about in the trees near the river. I saw a few of the beautiful black-and-white *Colobus* monkeys as they swung from tree to tree, but could not get a shot at any of them.

The journey I made down the river Ituri in the "pirogue" was peaceful and pleasant in the extreme. Here, running through a vast forest of giant trees and shrubs, consisting of gigantic false cotton-trees belonging to the order *Sterculiaceae* and other species of the *Rosaceae*, *Euphorbiaceae* and *Artocarpeae* orders, the river wound and turned. Now and then the sun's rays fell upon the pleasant waters causing them to glimmer like silver sheen. Here and there, all down the river, were scattered

innumerable small islands, on which grew a few tall trees, and on the trees could be seen many grey parrots; also sharp-eyed kingfishers, who sat on branches overhanging the river, looking, no doubt, for their breakfast in the rippling waters of the Ituri. Green and yellow paroquets, sun-birds, weaver-birds, and many others could also be seen flitting about among the trees and undergrowth.

The Ituri forest in certain parts contains many valuable woods, such as African mahogany, teak, greenheart, camwood, copalwood, ebony, and ironwood, and I also found there many species of *Landolphia*s (rubber vines), while by the rivers, where the forest sends out its prolongations, I have come across much of both kinds of rubber, good and bad, the latter consisting of a bastard species (*Funtumia latifolia*), the latex of which cannot be got to coagulate properly.

Orchids are very numerous, a red-and-white variety being the most common. Ferns are plentifully distributed throughout.

The Belgians have already surveyed a way through this forest in connection with their *Chemin de Fer des Grands Lacs* scheme, but in order to exploit this region one need not wait till this railway is constructed, for Lake Albert Nyanza is in close proximity to a part of the Ituri forest. Timber and produce generally could be shipped across the lake to Uganda, or taken down the Nile as far as Nimule. Just below this latter place, the Fola rapids of the Nile occur, which boats cannot navigate, so it is obvious that other means than transport by way of the river must be found. A very advisable plan would be for the Uganda government to consider the feasibility of continuing the Uganda railway from its present terminus (Port Florence) to Gondokoro, the point where the Khartum steamers call every month. Were the Uganda railway constructed to Gondokoro, the Sudan authorities might then consider the advisability of linking it up with the Khartum one. In the near future the trade of Central Africa must assume enormous proportions, and personally, I do not think that the Nile, as a means of transport, could cope with the increase of traffic which is bound to be the outcome of the development of such vast dormant territories as the Bahr el Ghazal, Uganda, and Central Africa generally. The advantages that would be gained by such a railway would be many, for it is well known that the aforementioned territories are very rich and fertile, and offer immense possibilities to the enterprising pioneer.

To the naturalist the Ituri forest should offer immense possibilities. It has not been thoroughly explored by white men yet, and extends over an area of some hundreds of square miles, and is only inhabited round the fringe by rubber "hunters," and the Wambutti or Mambutti race of pigmies. There that rare and beautiful animal, the okapi, first made known to science by Sir Harry Johnston, finds a home; and there it is free from molestation from big-game hunters, for it is next to impossible for a white man to hunt there, the forest growths being so dense. For this reason this rare animal will be safe from extermination for many years to come. Further north the white rhinoceros and beautiful eland are fast becoming extinct, by reason of the easiness of access to their haunts for indiscriminate sportsmen. We had not the

luck to see any of these animals on this trip, and during the time we were in the forest we only saw the spoor of a solitary okapi.

The Pigmies gave us some information regarding the okapi. I might mention, in passing, that the word okapi is from the Pigmy language, and the animal is known to them by this name. Colonel Harrison showed them a large coloured drawing of the animal, and many and loud were the exclamations on their beholding it. One man drew an imaginary bow to shoot it, and cries of "Okapi! Okapi!" were many.

They told us that, contrary to popular supposition, if disturbed, the animal does not run far away. They also informed us that its habits are similar to those of a forest hog, for it is often found wallowing in a mud puddle. It feeds on young shoots and shrubs, also succulent roots, which it digs up with its forefeet.

But to return to our journey—going back to the resthouse I found Colonel Harrison awaiting me, he having, like myself, returned without getting anything, so we decided to strike camp and make for Mayaribu. This place we reached about 4.30 in the afternoon. Going down the river we spied three small red buffaloes, but before the canoe could be stopped they had made off into the depths of the forest, where we were unable to follow them.

From Mayaribu we could hear the song and jest of the rubber-gatherers as they gathered the milky latex that was later to be converted into that commodity of commerce, rubber, over the smoke of their nut-fires.

From Mayaribu we proceeded to Kavalli, where we decided to stay a week or two, in order to get better acquainted with our little Pigmy friends, and, if possible, to try and get an okapi.

After having gained the confidence of the Pigmies, we went hunting one day with them. Starting out one morning as soon as daylight set in, we accompanied a band numbering somewhere about one hundred and fifty. They were all armed with the usual equipment for the chase, consisting of poisoned spears, bows and barbed arrows, and knives, which are about six inches long in the blade. They were also accompanied by a few mongrel-looking dogs about the size of a fox-terrier. Round the necks of these were hung iron rattles, which had a long slit on the underside. Into this slit a wisp of grass was stuffed to prevent them making a noise when not tracking game. As soon as any animal is raised the wisp of grass is immediately withdrawn, and away the dogs set in pursuit, the Pigmies following the sound of the rattle.

The Pigmies poison their spears, but, curiously enough it is not the blade which is poisoned, but the part of the stick next the blade. It is notched at this part, and the poison is rubbed into the notches, and this means that it must be driven in over the blade before the poison can take effect.

They have also a reed whistle upon which they perform a few "calls," which signifies various things. The hunting parties are usually divided up into two, one party driving and the other receiving the drive. We elected to stay with the latter party. After travelling for

about two hours on the forest path which leads to Fort Beni, and crossing a stream, we divided our forces, with the object aforementioned. We sent on the driving party to enter the forest at a point further east, while we, with the remaining party, tried to follow the stream. We were not long started when we heard a peculiar "call" on the whistle. We stopped, and were informed by our leader (a Pigmy) that the interpretation of the "call" was that something had been raised. We were at once on the alert, and waited with bated breath in expectancy. We did not need to wait long when another "call" sounded, this time entirely different from the first. We had no need to be told this time what it meant, for our leader rushed off to where the sound proceeded



FIG. 2.—A Balessé Hut in the Ituri Forest.

from, leaving us to follow as best we could, and when we reached the place we found not what we fondly expected (an okapi) but an "ingo-lubi," or forest-hog, lying in its last death-throes.

Sending it off to camp we set off through the forest again, but we only succeeded in getting a small forest antelope.

There are a great many small animals in this forest. This can be accounted for by the fact of the dense undergrowth; no large or medium-sized animal could force a way through, while smaller animals can creep through it without much trouble. We went on until about two in the afternoon, when, led by our friends, the Pigmies, we made for camp, which was reached about five in the evening. I was so tired out that I lay in bed the next day until twelve o'clock, when my boy came and informed me that the sun was "Gati Gati," that is halfway, or, in

other words, it was midday. By the time I rose and dressed, the Pigmies had come in, with another forest-hog, and then we had as much work as kept us busy until evening again.

When evening came we got our friends, the Pigmies, gathered round us, and tried to glean some information about their habits and customs, etc. The following are a few facts which I noted down at the time. If they wish to have success in their hunting operations, they, previous to setting out, cut a number of small slits down the back of their wrists, and rub in a concoction made from the roots of a certain shrub, then they call on Allah or God, whom they designate "Loadi," also their departed father (if he be dead), to watch over them and to prevent them from going astray in the depths of the forest. If one loses his way and never returns, the Devil, or "Ouda" as they name His Satanic Majesty, is supposed to have flown off with him to some unknown part. If a female child is born, the father gathers a few plantain leaves and brings them home, then he and the mother start to lash the poor infant with them. They do not want female children. On the other hand, should a male child be born, then there are great preparations made to celebrate this little one's advent into the world. A great feast is given at which unlimited banana beer (called "Choki") is consumed.

Polygamy is the recognised custom, it being usual for a man to have two or three wives, according to his means. Circumcision is practised also. Adultery is punishable by death.

They live chiefly on meat, the proceeds of their hunting operations. In hunting they are very skilful and nimble, and they are expert bowmen. I have seen them kill an elephant by following it and severing the tendons of the hind legs, while at the same time one would dart forward and thrust a large spear into the region of its heart.

Any surplus meat they may have is exchanged with their larger neighbours for grain, sweet potatoes, or bananas, but they are never seen by those with whom they made the exchange. At nightfall they bring the piece of meat and put it down in a prominent part of the village, and the following night they return to find in its place grain or bananas.

Another of their customs is this: if a father dies his sons construct a very small hut over his grave; and outside the hut that was once the home of the deceased, they make a small conical structure, into which they place a few pieces of meat and some bananas occasionally, thinking that one day he will return from the grave, and these articles of food are placed in readiness for him, in case he should be hungry.

The men wear a cloth which they make from the bark of a tree, and this cloth is usually dyed blue or red, the only two dyes that are made by them. The women wear a bunch of leaves.

They have many curious dances. They go through a regular system of hunting operations in the course of the dance, while the women trot round in a circle, decorated with long racemes of gaudy flowers hanging from their elbows, and parrots' feathers stuck through their hair. Another dance, the "sacred dance," is one which is a favourite with them. The chief dances round in a zigzag circle, followed by all the

others; suddenly he turns round and tries to overthrow the next one with his right leg. The first time he fails, or elects to fail; but on trying again he this time overthrows his man: this is said by some people to represent the great battle of Horus and Sut.

But to return to the characteristics of the region, we have in the Upper Ituri a vast fertile district comprising an area of many square miles, a part of which is clothed by primæval forest which, as I have elsewhere mentioned, contains many valuable commercial commodities. The



FIG. 3.—A Group of Shilluks, encountered near the Sobat, on the way to Khartum.

climate is splendid, and labour is plentiful and cheap. Many of the hillsides are covered with bracken, a species of mountain shield fern grows freely, while in the ravines and valleys I found the common bramble or blackberry fruiting freely. Further instances of the nature of the climate are to be found in the fact that strawberries from Europe were introduced here, and in the officers' gardens at Irumu they did wonderfully well, and fruited without having any special attention or covering from the sun. At this same place roses were blooming profusely at the time of our visit. Notwithstanding the fact that the sun is very powerful, and no rain falls for a few months, the sun has not

the injurious effect upon vegetation which one might suppose, for during the course of the night there falls a heavy dew which is very beneficial to vegetation.

In Chief Buna's domains, three days from Mahagi, there are great ravines, up which grow many *Dracaenas*, giant lobelias, and numerous plantains, also tree ferns. Another tree found growing here, although not in large numbers, is a species of *Symphonia*. This tree seems to be distributed over nearly the whole of Central Africa, from the West Coast to the East and in Uganda.

At the present moment the known natural resources of the Ituri are rubber and valuable woods in the forest regions, and native grain, bananas, etc., while gold is, at present, the only valuable mineral of any importance discovered.

In order to develop the wealth (vegetable and mineral) of the Ituri, it is obvious that some up-to-date method of transport must be employed. Railways would have to be constructed, for at present there are none. To develop every source of this territory's wealth a railway must be made, for whether it be rubber cultivation, cotton cultivation, grain growing, or gold mining which first attests the wealth-producing capacity of this territory, some means of transport must be considered. As I have mentioned before, the Belgians have surveyed a route for a railway through this district, in connection with the one which they are at present busily constructing towards the Great Lakes from Stanleyville, and which it is proposed to continue right on to Mahagi on Lake Albert Nyanza, thence to Rejaf on the White Nile. But as yet that railway has not nearly reached Lake Tanganyika, and when one considers that a railway from this last-mentioned lake to Lake Albert Nyanza has to be constructed through what is almost the most inaccessible part of Central Africa, it is obvious that it will be a long time yet before the natives of these parts are startled by the whistle of the "masua," as they name an engine. And if the wealth of the Ituri has to wait until this railway is made, it will not be developed for many years to come. On the other hand, seeing that it is the intention of the Congo authorities to construct their Great Lakes railway to Mahagi and Rejaf, why not begin to do this from both ends, *i.e.* from Stanleyville at one end and Rejaf at the other? By this means they would be able to finish their railway in very much less time, and as there are no formidable obstacles in the way of building a railway from Rejaf to the Ituri, it would reach that place in a very short time, and could be made to pay from the very start.

Even although it was a matter of a few years' time yet before the advent of a railway in these parts of the Congo which I have already mentioned, it would be an excellent plan in the meantime to employ capable men, such as economic botanists, trained arboriculturists, and men well up in all branches of scientific agriculture, also capable mining engineers, etc., in order to teach the natives there some of the best methods of raising the kinds of produce most suited to that particular part, and to develop the mineral resources and wealth of this region generally.

PROCEEDINGS OF THE ROYAL SCOTTISH GEOGRAPHICAL SOCIETY.

LECTURES IN FEBRUARY.

ON February 1, Professor Sir William M. Ramsay, D.C.L., LL.D., Litt.D., D.D., of Aberdeen University, will deliver his lecture on "Roads and Railways on the Plateau of Asia Minor" in Glasgow, on February 20 in Dundee, and on February 21 in Aberdeen. Mr. C. S. Seligmann, M.B., will address the Society on "Anthropogeographical Investigations in British New Guinea" (with cinematograph pictures) in Edinburgh on February 14, Glasgow on February 11, Dundee on February 12, and Aberdeen on February 13. Professor George Adam Smith, M.A., D.D., LL.D., will lecture on "The Historical Evolution of Jerusalem" in Edinburgh on February 21, and in Glasgow on February 22.

GEOGRAPHICAL NOTES.

ERRATA:—Geographical Photography.—In our last issue on p. 18, in the paragraph beginning "The late Dr. Schlichter," in the second line the word latitude has been inserted in error in place of longitude. On p. 16, Dr. Naddox should be Dr. Maddox.

ASIA.

Expedition to Burmah.—The pearl oyster fisheries of the Mergui Archipelago, lying off the province of Tenasserim, Lower Burmah, are to be the object of an investigation on behalf of the Indian Government, and for this purpose Mr. R. N. Rudmose Brown and Mr. J. J. Simpson left early last month for Rangoon. It is extremely probable that an examination of the ground may result in the discovery of new pearl banks, or at least the possibility of such banks being started. It is expected that the investigation, at least on its economic side, will be completed before the commencement of the south-west monsoon season in May.

AFRICA.

Ruwenzori.—The Duke of the Abruzzi lectured on January 7 at Rome, and at London on January 12, on his recent expedition to Mount Ruwenzori, and there is thus for the first time available official information as to his results. It will be noted that the official figures as to the heights of the peaks differ considerably from those previously given. The following is quoted from the *Times* report of the lecture:—

"Roughly described, the Ruwenzori range consists of six principal groups—divided by *cols* which average between 14,432 ft. and 13,786 ft. in height—stretching from north-north-east to south-south-west with a slightly circular trend. These groups and *cols* in their order, starting from north to south, have been named:—Mount

Gessi—*col* Roccati, Mount Emin—*col* Cavalli, Mount Speke—*col* Stuhlmann, Mount Stanley—*col* Scott Elliott, Mount Baker—*col* Freshfield, and Mount Thompson. Mount Speke corresponds to the Duwoni of Sir Harry Johnston, and Mount Baker to the Semper or Kiyanja. The separate peaks of these groups have also been named. The highest group is the Mount Stanley, where two adjacent peaks, named Margherita and Alexandra, reached respectively the heights of 16,815 and 16,744 feet. They were among the first climbed by the Duke, who had reason to recognise at once their superior height to the rest of the range. It was on June 17 that he made the ascent of peak Alexandra, arriving at the summit at 6.30 in the morning. At that hour the whole range was covered by a level sea of white mist, out of which stood two islands alone, the snowy top of Alexandra, from which he looked, and that of Margherita. Five hours later, at 11.30 on the same morning, he was on the summit of Margherita and had ascended the two highest points of the range.

"The snow was always in good condition, and the climbing, both on rock and ice, never presented any difficulty. The lowest point of glacier was at 13,677 ft. All the glaciers show signs of receding; none were of the first order, all being, without exception, of the secondary order, without tributaries, recalling the glaciers of Scandinavian type. There was no *névé*. The limit of perpetual snow was at about 14,600 feet; the area covered by it had a radius of some five miles from its centre. The temperature upon the highest summits varied between a *maximum* of 42.8 degrees Fahrenheit, and a *minimum* of 26.6 degrees. The chief difficulty experienced was the weather, which was hardly ever clear. In spite of its conditions, the Duke of the Abruzzi and his companions succeeded in all the objects of their expedition, making an exact survey of the range, climbing, determining the height of its several summits, fixing the watershed, and bringing back, besides their maps, an admirable series of photographs, the work of Signor Sella."

From the above it appears that Mr. Wollaston (cf. xxii. p. 380) was correct in believing that no peak of Ruwenzori exceeds 17,000 feet in height.

AMERICA.

Earthquake in Jamaica.—A severe earthquake shock occurred in Jamaica on 14th January, and caused great destruction of life and property in the town of Kingston. As has frequently happened lately, the shock was followed by destructive fires, and has apparently caused the subsidence of parts of the harbour and the neighbouring coast.

POLAR.

Meteorology in the Antarctic.—It will be remembered that several members of the staff of the recently closed Ben Nevis Observatory left more than a year ago to continue the meteorological and magnetic work initiated in March 1903 by Mr. W. S. Bruce, leader of the Scottish National Antarctic Expedition, at Scotia Bay, South Orkneys. News has been received from Buenos Ayres to the effect that the Antarctic research

ship *Uruguay* left that port on 11th December last for the South Orkneys with a party under the leadership of Mr. Angus Rankin, late superintendent of the Ben Nevis Observatory. Included in the party is Mr. Meldrum, a son of the late Dr. Meldrum, C.M.G., of Mauritius, who is well known for his meteorological work.

The *Uruguay* takes plenty of provisions in case the party has to winter in these latitudes, as it is understood that the ice conditions this year in the south are exceptionally bad, the pack lying further north than previously recorded.

On the return of the *Uruguay* to Ushuaia, the second party, consisting largely of members of the late Ben Nevis Observatory staff, under the leadership of Mr. Bee, was to leave for Wandel Island, at the southern extremity of Gerlache Strait, Charcot's winter quarters, where a new meteorological and magnetic station will be established.

Before leaving Buenos Ayres, Messrs. Rankin and Bee were invested by the Argentine Ministry with the official insignia of office pertaining to the position of Political Officer for these places, so that by this time their formal annexation to the Argentine Republic has been consummated.

The station at South Georgia is also being continued, while the installation of parties on one of the islands of the South Sandwich group, as well as on the west side of the Falklands, is contemplated in the immediate future.

This comprehensive scheme of work cannot fail to very materially advance our knowledge of the meteorology and magnetism of the area lying to the south and west of Cape Horn, especially as the meteorological service of the Argentine Republic is already in a high state of efficiency. This elaborate programme is largely due to the initiative and enterprise of Mr. Walter G. Davis, Director of the Argentine Meteorological Office, whose efforts have been cordially supported by the Ministry of that country.

The Peary Arctic Expedition.—Some further details may be added to the short account which was all that space permitted in our December issue.

The *Roosevelt* left Etah on August 16, 1905, and reached Cape Sheridan on September 15. The ice then enclosed and held the ship, and she was made fast there for some days. The ice jammed, damaging the rudder and propeller and unmercifully squeezing the vessel, which on the 16th was lifted till her propeller showed. The vessel was not floated again until the following summer, and this position perforce became headquarters. Supplies and equipments were landed on October 12, and from the summit of Black Cape, Peary saw the sun for the last time. The winter proved the direct antithesis of that which the *Alert* experienced in the same region. The temperatures were comparatively high, and there were squalls every few days, sometimes continuing as furious gales for two or three days. During October there was a rapid succession of deaths among the dogs. It was traced to poisoning from cured whale-meat, several tons of which had accordingly to be thrown

away. During the winter the dogs and the Esquimos lived in consequence upon the country, obtaining musk oxen, reindeer, hare, and salmon, and building snow-houses in the Lake Hazen Basin, where they were sent by Peary.

On February 21, Peary started on a sledge trip in the direction of the Pole, several parties having preceded him by a couple of days. Three marches brought him to Cape Hecla, where the entire expedition assembled. The encampment comprised Bartlett, Wolf, Marvin, Henson, Clarke, Ryan, Peary, 21 Eskimos, and 120 dogs. The plan concerted was to proceed in one main and five or six division parties, which Peary hoped would be able to advance supplies and maintain communications with the selected base. Point Moss, lying 20 miles to the west of Cape Hecla, was determined upon as the point of departure from the land. Open leads and rough ice rendered progress slow, and a considerable portion of the trail had to be cut with pick-axes. The first glimpse of the sun was obtained on March 6. About 80 miles from the land the character of the going greatly improved, but leads were more frequent and wider. "At latitude $84^{\circ} 38'$," says Commander Peary, "I came up with Bartlett, Henson, and Clarke, with their parties stalled by a broad lead extending east and west as far as it could be seen. After a delay of six days, we crossed on young ice, which bent beneath our weight. Bartlett and Clarke were sent back for supplies."

Peary then established a *cache*, in which instruments were placed for the supporting parties, and, preceded by Henson, then continued his journey, but three days later it began to blow heavily. The gale lasted six days, during which Peary and Henson were driven 70 miles eastward by the drifting of a great floe on which they had encamped. Two of the Eskimos were then sent back for news. They returned in seventy-four hours and reported that the ice was wide open to the south. Nothing had been seen of the supporting parties. In consequence it was resolved to make a dash for the Pole, and by forced marches, on April 21, $87^{\circ} 6'$ was reached, as already mentioned. Here it was found necessary to turn, and great difficulties were then encountered. After harking back to latitude 84° , a big lead was encountered over which no crossing could be found. The party camped on a big floe, which drifted steadily eastward. Here the dogs were driven away and the sledges broken up to cook the dog-meat, which the party ate. On the fifth day the two Eskimos reported young ice a few miles distant, which the party eventually crossed on snow-shoes. After fearful difficulties the party dragged themselves on May 12 into the ice at the foot of the Greenland coast, at Cape Neumayer. Here, two days later, a junction was effected with Clarke's party, and seven musk-oxen were secured.

The remainder of the march back to the *Roosevelt* was accomplished without any extraordinary incident. Commander Peary made another trip, leaving records at various points, including Cape Columbia. On July 30 he returned to the *Roosevelt*, which next day steamed for Thank God Harbour. On August 25 the vessel was delayed by the ice in Lady Franklin Bay, where the case seemed so hopeless that the explorers

prepared for a second year's sojourn in the frozen north; but the *Roosevelt* managed to get free and the voyage was resumed. At Etah the ship was beached for four days for repairs. When more open water was reached storm after storm was encountered, and the *Roosevelt* was beaten back and forth for days, until she finally reached Labrador. The voyage from Labrador southward was also very stormy.

The Amundsen Polar Expedition.—Capt. Roald Amundsen returned to Christiania towards the close of November, after his three and a half years' absence in Polar regions. The records of his magnetic observations will be worked out in Christiania, and he has presented his entire collection to the Norwegian Government. Among the honours which he has received may be mentioned the cross of St. Olaf bestowed upon him by the King of Norway. Before leaving America, Captain Amundsen was entertained by the Geographic Society of Chicago, when addresses were delivered by American geographers and others. The first-fruits of Captain Amundsen's expedition have already reached us in the form of a pamphlet entitled *Northern Waters*, by Dr. Fridtjof Nansen, which discusses the results obtained during the *Gjøa's* preliminary oceanographical cruise in 1901, in their relation to the question of the origin of the bottom waters of the Northern Seas.

New Arctic Expedition.—It is reported from St. Petersburg that an expedition to the Arctic regions is being equipped there under the leadership of Lieutenant-Colonel Sergeyeff. The expedition is expected to last for several years, and will start from Yeniseisk, making from there for Behring Strait.

The Duke of Orleans' Greenland Expedition.—In vol. xxi. p. 610 we give a brief account of the chief results obtained by the Duke of Orleans in his expedition to the north-east coast of Greenland in the *Belgica* during the summer of 1905. In *La Géographie* for September 15, Commandant de Gerlache gives a detailed account of the cruise, accompanied by a chart of the ocean between Spitsbergen, Greenland and Iceland, and a sketch-map of the new parts of the coast of Greenland discovered by the expedition. A narrative of the expedition by the Duke has also reached us, and a volume of scientific results is to appear shortly.

Perhaps the most interesting point as regards the general results is the proof of the existence of an elevation of the sea-bottom between Spitsbergen and Greenland. In lat. $78^{\circ} 13'$ and long. 5° W. of Greenwich successive soundings of 1476 fathoms, 1152 fathoms, and 779 fathoms were obtained, indicating a rapid rise. At a later stage in the cruise, in almost the same latitude, but in long. 14° W., off the coast of Greenland, a submarine bank rising to 31 fathoms of the surface was found, but unfortunately the condition of the pack prevented the complete investigation of this region. It is, however, possible that an island occurs here. The elevation has been called the Belgica bank.

The sketch-map shows the new portion of the coastline so far as it was possible to depict this under the very unfavourable conditions of

fog which prevailed. The stretch of land previously called France Land has now been called Duke of Orleans Land, while the island on which Cape Philippe is placed, and on which a landing was effected, has been named Ile de France. This island is apparently an old moraine, and proved to be nearly bare of ice in its southern part. Though there is very little vegetable soil yet the flora proved rich, 19 phanerogams, 7 mosses, 4 fungi, and 6 lichens being found here.

Scottish National Antarctic Expedition.—Another of the bottle-floats despatched on the voyage of the *Scotia* has been received by the Admiralty. This float was thrown overboard on July 2, 1904, in lat. $36^{\circ} 5' N.$, long. $30^{\circ} 50' W.$, and was recovered on November 6, 1906, about two miles from the north end of Long Island, Bahamas, lat. $23^{\circ} 20' N.$, long. $75^{\circ} 07' W.$ The bottle thus travelled at least 2427 miles in 867 days or less, or at an average rate of at least 2·8 miles per day.

GENERAL.

The Italian Geographical Congress of 1907.—By the courtesy of the Executive Committee, we have received a copy of the circular in regard to the meeting of the Italian Geographical Congress, from which we extract the following details:—

The Congress is to be held in Venice, from the 26th to 31st May 1907, under the patronage of H.M. the King of Italy. Intending members must send in an intimation, with the subscription of 10 lire, addressed “Al Comitato Esecutivo del VI Congresso Geografico Italiano, Venezia.”

The President of the Executive Committee is Baron Treves de' Bonfilii, senator.

The Congress is divided into four sections:—1. Mathematical, physical, and anthropological geography. 2. Economic, commercial, and colonial geography. 3. Educational (geography in education; the cultivation and diffusion of geographical knowledge). 4. Historic (the history of geography and cartography, place-names, etc.).

The Council is endeavouring to secure all facilities for the members, so that both travelling and accommodation may be as reasonable as possible. Tempting excursions of various kinds are being planned.

The Geographical Association.—The annual meeting of the Geographical Association was held at the London School of Economics and Political Science on January 4. The annual report shows that the Association is steadily increasing its membership, there being now 535 members on the roll. The President of the Association, Mr. Douglas Freshfield, in his address discussed at some length the recent action of the Civil Service Commissioners in excluding the subject of geography from the examinations for the Foreign Office and Diplomatic Service, and expressed the hope that the recent decision would be soon reversed. Subsequently Dr. W. N. Shaw delivered a lecture on Atmospheric Circulation.

Ninth International Geographical Congress.—We have received the Invitation Circular together with the preliminary programme of this Congress, which is to be held at Geneva from July 27 to August 6, 1908. Copies of the Circular, together with forms of application for membership, may be obtained from the Comité d'Organisation, Athénée, Geneva, Switzerland, while subscriptions should be paid to M. Paul Boma, 3, boulevard du Théâtre, Geneva. The preliminary programme is of a very attractive nature, and the proceedings are expected to include two or three excursions to the Central Alps, so readily accessible from the city. The President is to be Dr. Arthur de Claverède, the President of the Geographical Society of Geneva.

EDUCATIONAL.

IN the December number of the *Geographical Journal* there appears in full the paper on Social Geography which Professor G. W. Hoke read at the last meeting of the British Association. This paper may be strongly recommended to the notice of teachers because of its fresh and interesting outlook. Professor Hoke defines social geography as the subject which deals with the distribution in space of social phenomena, the object, as in the case of any other science, being the ultimate acquisition of the power of predicting the future distribution of similar phenomena. Now it is, of course, a commonplace of geographers that the characteristics of a social group are in a large measure determined by the surrounding physical conditions—probably no lesson on the people of Great Britain was ever given without some allusion to the “silver sea”; but man is a migratory animal, and when he travels to a new environment he carries with him into the new region the social and other characteristics produced in the old. The result is that the new group produced cannot be explained simply in terms of the new physical conditions. Professor Hoke illustrates this point by two striking examples. The American Indian in the Mississippi exemplified man as hunter, and the only result of the impact of European culture was to make him hunter more than ever by giving him weapons which made hunting more effective. But when the European migrants poured into the same valley their traditions made them largely agriculturists before pressure of space made this a necessity of life. A remnant by social atavism swung back to the hunter's life, and became much like the Indians. Still another portion, with the migratory instinct which had brought them thither predominating, devoted themselves to methods of transportation. Thus we have an example of one type of physical conditions producing three types of social life. On the other hand, as the stream of migrants to the west pushed through the Appalachian barrier on their way, a portion of them were left behind in the mountains and remain there to this day in almost the same social condition as that in which they reached the new continent. Originating from the Highlands of Scotland, they have preserved in the Appalachians almost all their racial characteristics,

while their brethren of the west have segregated into hunters, farmers, and commercial men.

The other example is the changes which the immigrant Asiatic nomads have undergone in the Balkans. Pouring in upon Europe through the Ural Gap some of these found themselves in their southern course penned in the valleys of the Balkans. Retreat was impossible because of the pressure behind, advance by the relief of the land, hence a forced adaptation had to take place. But the whole social life was based upon the free life of the steppe, and the community therefore split into two sections. The most adaptable became agriculturists and modified their whole organisation to suit, the other section, for whom this was impossible, naturally became robbers and brigands. The difference then between their fate and that of the Appalachian Highlanders is not based upon any geographical difference of relief but upon a difference of social tradition.

Geographers have often shown how important is the assistance which their science can lend to the historian—a point which is emphasised below; but this paper of Professor Hoke's is interesting as showing that the converse is also true, that the geographer requires to call in the aid of the historian before he can fully explain the reaction of man to his environment. We may say even further that the new and as yet despised science of sociology must also be called to his aid. As suggested above, however, we might say that what Professor Hoke calls the social status is in essence merely a geographical factor, for it is the product of the previous physical surroundings of the race.

Another interesting paper which illustrates a second way in which historical and geographical teaching may be correlated, is to be found in the *Annales de Géographie* for November 15. The article is entitled "La Géographie de la Circulation, selon Frederick Ratzel," and the author, M. Hückel, aims at giving a general critical account of Ratzel's views on the development of ways of communication, as these views are set forth in the last edition of *Political Geography*. Incidentally M. Hückel has a good deal to say himself that is fresh and interesting.

It is impossible here to give a general account of the article, which should be consulted by those interested, but a few striking points may be mentioned. The central point is that historically the means of communication have shown a constant tendency to evolve, and that this evolution affords an interesting parallelism in development with the more familiar evolution of the drainage systems of the earth's surface, as this evolution has been expounded by the physical geographer. The tendency has always been to shorten the line, and though for a time trade may be artificially forced to take a certain course, in the long-run the tendency is for it to take the course marked out by the physical features of the earth. Very striking in its relation to history is the dictum that the tendency is always for the trade routes to pass from the surface of the land to the oceans or the rivers. This tendency, of which there are many examples, has had a very important bearing on the history of many of the nations. Thus the discovery of America and the

utilisation of the sea-route to India ruined the Mediterranean area and the countries to the east of it which had grown rich on the carrying trade from the Far East. One of the most curious examples of the reversal of a historic process is the way in which the opening of the Suez Canal has brought back wealth and prosperity to parts of that ruined area. Again, the vast historical importance, in their different ways, of the Semites, the Greeks, the Italians of the Middle Ages and later, is geographically to be explained as due to the fact that these nations were the middlemen between the resources of the East and the civilisation of the West. Once more, the persistent historical error which has led the Westerns to greatly overestimate the former importance of such countries as Arabia has a geographical origin. Arabia was never anything but an entrepôt, a country on the great trade route from the East to the West, but owing to the vast distance which in the days of slow transport separated the Far East from the West it came to be erroneously regarded as itself the region of origin of the commercial products. These are only a few of the interesting points with which the paper deals, but they may serve to show other ways besides that mentioned above in which history and geography may be correlated.

NEW BOOKS

EUROPE.

Spain and her People. By J. ZIMMERMAN, LL.D. London : T. Fisher Unwin, 1906. Pp. 350. Price 10s. 6d. net.

While Spain has for many years been one of the favourite resorts of British travellers, the author informs us that his American fellow-countrymen have been deterred from going there by "blood-curdling tales." We have no idea whence these tales originated, and, like the author, are satisfied that there was no foundation for them. Like him, too, we always found the Spanish people courteous and kind. The author dwells on the historic depopulation of Spain, pointing out that "from a population of 70,000,000 in the days of the Emperor Augustus, Spain has dwindled to barely 18,000,000." He does not inform us, however, how he obtained the statistics of Spain during the reign of Augustus Cæsar. He remarks that her main modern disabilities are the existence of 70 per cent. of illiterates, lack of individual enterprise and patriotism, absence of cohesion among her different provinces, constant friction from various quarters, prevailing poverty, and a depleted treasury. This is a heavy indictment and is probably true, with the exception of want of patriotism, for as the Spanish guerilla war against the French proved during the Peninsular War, the Spaniards could fight valiantly against a foreign foe. Unfortunately, the Spaniards are their own worst enemies.

Dr. Zimmerman's tour carried him from Algeciras to Grenada, and he describes graphically the Alhambra. Then follow Seville, Cordova, Madrid, The Escorial, Segovia, Toledo, Saragossa, and Barcelona, with chapters on Spanish Life and Character, the Spanish Inquisition, the Expulsion of the Jews, the Moors in Spain and their expulsion, Causes of the Decline of Spain, and the Future of Spain. He found travelling in Spain agreeable, the hotels comfortable, and the railway trains punctual although slow. We can commend his descriptions as full

and accurate, while the illustrations are well selected and well executed, although a map might have been added.

As a British princess is now Queen of Spain, great interest is in Britain naturally taken in Spain's future. The author discusses it from an American point of view, and remarks that if America had the control of Spain, "it would be easy enough to say that Spain would become one of the great countries of Europe, for all the natural possibilities remain, and there is no reason for the continuance of bad government, with ignorance, intolerance, and poverty that stand in the way of progress." He points out that the rivers of Spain do not help her like those of America, the Guadalquivir being the only really navigable one. He contends that "what Spain needs is a radical change in ideas and customs, and this must come from without," and advises her to send hundreds of her young men to the United States to study American methods of progress, declaring "We could make a new and great country out of Spain within twenty-five years," for "Spain is rich in natural resources, and by proper cultivation the productive wealth could be increased at least threefold, and this is not overestimating her industrial capabilities."

A Scientific Geography. Book II., The British Isles. By ELLIS W. HEATON, B.Sc., F.G.S. London: Ralph Holland and Co., 1906. Price 1s. 6d.

This is a good little book, the first published of a series, intended, as the preface states, rather to correlate and explain the facts of geography than to set them forth. The chief fault we have to find is that the book is throughout written with, as it were, one eye upon the examiner. The object of the student—for the book is not intended for junior pupils—is supposed to be to get through his examination rather than to realise the joy of knowing and of reasoning. From the geographer's point of view this is a grave neglect, if not an unnatural one. But there is much that is fresh and interesting in the treatment, and the teacher will get many hints from the perusal of the book. The constant insistence upon simple sketch-maps is a valuable feature, though those actually given are usually rough.

Baedeker's Rhine from Rotterdam to Constance. With 52 Maps and 29 Plans. Sixteenth Revised Edition. 1906. Price 7 marks.

"The Rhine" is perhaps one of the most popular volumes of Baedeker's Series, and no effort seems to be spared to maintain its popularity. The fifteenth edition was issued in 1903, and in the revision consequent on the three years' interval no less than 7 new maps and 3 plans have been added.

Handy Guide to Norway. By THOMAS B. WILLSON, M.A. With 7 Maps. Fifth Edition. London: Edward Stanford, 1906. Price 5s.

New routes and hotels are every year being added to the many attractions for the tourist in Norway, so that old editions of guide-books soon become obsolete. Mr. Willson's little handbook has been revised and augmented in the present edition, and forms a most useful compendium of practical information for travellers.

Christian Rome. By J. W. and A. M. CRUIKSHANK. London: Grant Richards, 1906. Price 3s. 6d. net.

The Eternal City offers so much to be seen that special hand-books are necessary. In this one the Rome of Christian times is thoroughly investigated, beginning with the Early Church illustrated by the Catacombs, then proceeding to the Bishopric of Rome as localised in St. John Lateran, St. Peter's, and the

Vatican. A valuable series of excursions is given with drives about the city, also a summary of the principal examples of Early Mediæval, Gothic, and Renaissance art in Rome. After a description of the various churches and picture galleries in Rome, a detailed account is appended of Subiaco, 45 miles east of the city, for the compilers consider that an effort should be made to visit this place "not only for its associations as the cradle of Western monasticism, but also as affording a dramatic contrast to the effects of the ecclesiasticism of the seventeenth and eighteenth centuries in the Roman churches." The volume is most carefully compiled, practically arranged, and of a form suitable for the pocket.

A Cruise across Europe. By DONALD MAXWELL. London: John Lane, 1906.
Price 10s. 6d.

This amusing book, some of the pages of which recall the well-known style of Jerome K. Jerome, is a "collection of notes and sketches," made in the course of a cruise across Europe by a route probably unknown to nine-tenths of our readers or even to many experienced yachtsmen. The *Walrus* crossed from an unnamed seaport near Flushing to Willemstad in North Brabant, and from there made her way to the Black Sea "by devious windings through the Continent of Europe, by river and canal and across the Franconian Jura Mountains, by means of Charlemagne's ancient and almost unknown waterway to the valley of the Danube." Nothing very exciting or remarkable occurred in the course of the cruise, unless we account as exciting the fact, that the author and his companion were twice supposed to be spies, first, in Holland, and again, at a small Hungarian village near Buda-Pesth, and were detained for a short time pending receipt of official instructions from the authorities. On another occasion they found themselves on the festival of St. Mark in an obscure Hungarian village, where the populace mistook them for holy pilgrims on their way to Palestine and liberally regaled them with goods and presents. Some of the hundred illustrations are clever and amusing, and special attention is invited by the publisher to the frontispiece "which has been specially reproduced under the direction of the author."

ASIA.

Things Seen in Japan. By CLIVE HOLLAND. London: Seeley and Co., 1907. Price 2s. net.

This little book bears out its title. There are no fewer than fifty photographs which reproduce scenes characteristically Japanese, while the book itself gives a better idea of Japanese life than many a more pretentious volume. It will be enjoyed by every one who reads it. Mr. Holland cannot altogether disregard the change which is coming over the country through its assimilation of Western ideas, but his object is clearly to preserve for us the Japan of tradition. Probably the traveller must haste if he is to find everything as Mr. Holland describes it. But Japan may be trusted not readily to part with customs and manners which enter so largely into the life of her people. From this point of view the future history of Japan to those who, like Mr. Holland, have known the country before its progressive moment must be intensely interesting.

India. By PIERRE LOTI. Translated from the French by George A. F. Manan. Edited by Robert Harborough Sherrard. London: Werner Laurie, 1906.
Price 10s. 6d. net.

The distinguished writer of *Madame Chrysanthemum* does not leave us long in doubt as to why he went to India. "I make my way to India," he says in his Preface, "the cradle of human faith and thought, with nameless dread, fearing that

I may find nothing but a cruel and final deception. I have not come here to make a trifling call, but to ask or beg the keepers of the Aryan wisdom to give me their belief in the lasting duration of the soul in place of the ineffable Christian faith which has vanished from my soul." After a few days in Ceylon he crossed the "ever-raging" Gulf of Manar, and on the 20th December 1899 landed on the Travancore coast. Apparently he was in great hopes that the abstruse question of the lasting duration of the soul would be solved for him within a week of his arrival. Still more remarkable was it that he should imagine his difficulties would be solved by the Maharajah of Travancore of all the people in India. His business with the Maharajah was to convey to him a French decoration, which he did on Christmas Eve; and after the usual conversation about anything and everything except religion Pierre Loti says, "I regret that I have been unable to converse on more serious subjects with this amiable prince, whose soul must be so different from our own. My first interview has taught me that the mysteries of his inmost thoughts will be as impenetrable to me as the great temple. There is a radical difference of race, ancestry, and religion between us: thus we do not speak the same language, and the necessity of speaking through a third person forms (in spite of the affability of my interpreter) a barrier which isolates us from all communion." From Tinneveli he passed on through Malabar to Pondicherry, and of course he does not miss the opportunity of doleful lamentations over the departed glories of the formerly prosperous French settlement. Here, however, probably to dispel his patriotic gloom, a nautch was given in his honour, which so far as he was concerned seems to have been an unqualified success. Readers of his other works will know what to expect, and they will not be disappointed. One particular bayardere had "come from afar for this evening, from one of the temples of the south, where she is in the service of Siva; her reputation is great, and her performances are costly." But it was worth it, "for I dreaded the moment when it (her dance) would end and I should see her no more. . . What thoughts can there be in the soul of a bayardere of the old race and the pure blood?" To this somewhat indiscreet question, most judiciously, no answer is given. From Pondicherry he made his way to Haiderabad, or, as he repeatedly and quaintly calls it "Nizam," where apparently he first encountered the famine. His description of it in Haiderabad and Oodeypoor is lurid enough, but it is not till he gets to the country of Ragput (*sic*) and "the beautiful rose-coloured city," *i.e.* Jaipur, that he lets himself go. And then neither in the pages of the English Defoe nor in those of his own countryman Zola do we find such triumphs of gruesome realism as we find in this volume. One passage, and that by no means above the average in horrors, will suffice for quotation. "A French stranger alights and advances towards one of these dreadful, inert heaps of starving human beings, and stoops down to place pieces of money into their lifeless hands. Immediately it is as though a horde of mummies had suddenly risen from the dead. Hands emerge from the rags that covered the heap, and withered and bony forms rise slowly from the ground. The ghastly resurrection suddenly extends to other heaps lying hidden behind the piles of merchandise, the crowds and the furnaces of the pastrycooks, for they seethe and stir and grovel on the ground. Then a swarm of phantoms advances with faces of dead men, with horrible, grinning teeth, with eyes whose lids have been eaten away by the flies, with breasts that hang like empty bags on their hollow chests, and with bones which rattle as they walk. Instantly the stranger is encircled by those spectres of the charnel-house." From Jaipur he of course visited Amber, where he casually mentions he heard "the melancholy, flute-like voice of wandering jackals," a description of the jackals' hideous yells which we make bold to say has never occurred to any one

before or since. From Amber he went on to Gwalior, where he inspected the famous fortress and Lashkar from the top of an elephant, "so tall that we were on a level with the first floors of the houses. The streets were so narrow that we could even touch the delicate traceries of the sculptured galleries on which fair ladies were sitting, who saluted us as we passed by," a proceeding, which must have greatly amused or scandalised the mahout and attendants. From Gwalior he paid a short visit to Jagganath, and then went on to Agra and Delhi, where the magnificent buildings of the Moghals seem merely to have filled him with melancholy and gloom. "The land," he says, "in which the Mogul Emperors lived is now but a winding sheet for ruined towns and palaces," a description calculated to evoke a smile from those who have seen the flourishing cities of Delhi, Agra, Cawnpore, Lucknow, and many others. At the famous Kutb near Delhi, which by the way he calls Kuth, and describes as built of pink granite, he heard, "the shepherds play on muted pipes," an experience certainly unique in its way.

The traveller's goal was Benares. He had been assured by the Theosophists in Madras, where by the by he heard "the crows intone their noisy hymn to Death," that at Benares he would have all his distracting doubts resolved, and would there certainly find the peace which even they could not give him. To the suggested pilgrimage to Benares accordingly he consented gladly, but decided to "defer that last test as long as possible, for I still hesitated like a coward whom a double fear assails. It might be that all my hopes would be taken away from me for ever or I might find. Then perhaps the new way would open out before me and an end would come to all these earthly joys, mere illusions doubtless, but still so delightful." So he wended his way to Benares; and we have several gruesome and realistic descriptions of the Fakirs and cremation of the dead, and of the filth of the streets, temples and river. At last he found himself in the House of the Masters who "work or meditate the whole day, together or alone. The plain tables before them are loaded with those Sanscrit books containing the secrets of that Brahmanism which preceded all our religions and philosophies by so many thousand years. In these unfathomable books the old thinkers, those sages who had clearer vision than any men of our race or age, have inscribed the sum of all human knowledge. To them the inconceivable was almost clear, and their long-forgotten works now pass our degenerate understanding; and so, to-day, years of initiation are required merely to see, hidden dimly amidst the obscurity of the words, the unfathomable depths beyond." Among the masters he found a European woman—possibly Mrs. Annie Besant—"her face still beautiful though crowned with silver hair, and she lives here barefooted and detached from earthly strife, the thrifty and austere life of an ascetic." Guided apparently by her, he took the simple oath required of him and became a disciple; but happily for his readers he declines to attempt to repeat what the Masters commenced to teach him. We must be content to believe on the traveller's authority that the Masters at Benares "alone can give answers which will satisfy the burning questionings of the human mind, and such evidence is brought before you that it is impossible to doubt the continuance of life beyond the terrestrial sphere." And so the traveller seems to have had his doubts resolved and to have found the peace of which he was in search. Our readers, and especially those of them who know India well, will find this a very amusing book.

Life and Adventure beyond Jordan. By the Rev. S. ROBINSON LEES, B.A., F.R.S.S.
London: Charles H. Kelly, 1906. Price 5s. net.

This pretty, well-written volume owes its value very largely to the illustrations from fine photographs by the author. Eight of these are coloured plates, and more

than a hundred reproduce effectively the scenery, the ruins, and sometimes the people of Eastern Palestine, from the cedar of Lebanon south through El Hauran, Bashan, Gilead, and Moab. The book is popularly written, and frequently illustrates the narratives of the Bible ; but it is not scientific, and has little geographical value.

Indian Life in Town and Country. By HERBERT COMPTON. London : George Newnes, Limited, 1906. Price 3s. 6d.

This little volume on Indian Life in Town and Country is the latest publication of "Our Empire" series. In the short compass of 200 pages Mr. Compton, who seems to have been a tea-planter, has made a creditable attempt to convey to English readers his impressions of ordinary Indian life and manners, both among the natives and among the Europeans. And we have little doubt but that Mr. Compton intends to be scrupulously accurate, and he must be acquitted of any charge of conscious malice or exaggeration. But Anglo-Indians who have had quite as much experience of India as Mr. Compton will smile at such statements as these, "bribery and corruption are the rule, not the exception, in the East. In every transaction of life it is held to be not only allowable but sensible to derive some advantage over and above the scheduled amount." "When you come to the subordinate judicial staff, the active judges and magistrates, with restricted powers and comparatively small salaries, you may take it as an axiom that, in our slang phrase, they are all 'on the make.' Prudence alone puts a limit to their harvest." "The Indian native official is a currish-spirited thing at the bottom . . . a consummate actor and Machiavellian schemer, who seldom fails to worm himself into favour." "Crime is safe and easy in the zenana, for even the law halts on the threshold." Even when he is describing Anglo-Indian life Mr. Compton cannot be accepted as ordinarily accurate, when he says, "India luxuriates in hermetically sealed stores. These are the dainties of Anglo-Indian daily life, the delicacies of the dinner-party." "Ladies are pedantically jealous, and woe betide the unhappy hostess who makes some quite unintentional error in the order in which she sends her guests into dinner." "The press of India does not represent public opinion, but the views of Government ; its chief subscribers are Government officials, and it is dependent on the powers that be for news, not to mention fat contracts for advertising and printing. The non-official is without a vote, without representation, without privileges, and without rights, even although he be a free-born Englishman." But enough of quotations. We are inclined to suspect that Mr. Compton is attempting to describe some phases of India of at least a generation ago. Even if this is the case many of his descriptions will not be accepted as correct by those who knew the country well in those days, any more than they can be accepted as true of India in the twentieth century.

AFRICA.

Second Report: Wellcome Research Laboratories at the Gordon Memorial College, Khartoum. By ANDREW BALFOUR, M.D., B.Sc., F.R.C.P.Edin., D.P.H. Camb. Published by the Department of Education, Khartoum, 1906.

This valuable volume gives the results of the work done at the Wellcome Research Laboratories at the Gordon Memorial College, Khartoum. To geographers it is of great interest on account of the work it is doing in rendering the Sudan more healthy and thus opening it up for possible settlement. To the medical profession the war against malaria and the ascertaining of the causes of tropical diseases will appeal. The success of the measures taken to

exterminate mosquitoes and other infection-bearing insects is wonderful and most encouraging.

The book contains a wealth of information for the sanatarian, doctor, and naturalist ; it is exceedingly well produced, and reflects the greatest credit upon Dr. Andrew Balfour, the Director of the Laboratories, and his assistants.

Being of an entirely technical character, it is not a book for detailed review by us, but we very warmly commend it to those engaged in the warfare against tropical disease. We are glad to see that attention is now to be paid to agricultural chemistry, bacteriology, etc.

The illustrations are excellent.

Portuguese East Africa. By R. C. F. MAUGHAM. London : John Murray, 1906. Price 15s. net.

This interesting work on Portuguese East Africa, and more particularly on the districts of Maurica and Sofala is very welcome, as it supplies a distinct want. We have a plethora of works of all sorts and qualities about British Africa ; we have had a lurid light thrown more than once on the Congo State ; and we know a good deal about French and German Africa. A trustworthy work from an able officer of sufficient experience, dealing with several important subjects of interest in Portuguese East Africa was wanted, and is found in the volume now before us by Mr. Maugham, the British Consul of Mozambique and Zambesia. A perusal of the work shows that Mr. Maugham has many peculiar qualifications for the task. He very modestly observes that "this book is intended for the traveller, the sportsman, and for him whose delight lies in those scenes of natural unembellished beauty and grandeur which Africa possesses in such profusion and variety" ; but in addition to these, the book will successfully appeal to the student of history, anthropology, colonisation and administration, and to the ever-widening circle of those who are interested in "dark" if not "darkest" Africa. Mr. Maugham has had twelve years' experience of the regions which he describes, and it is very obvious, that he has not only made excellent use of his exceptional opportunities, but that, in a more than ordinarily trying climate, he has had the requisite energy and ability to see and think for himself, and to state his matured convictions and observations with eloquence and persuasive force. We trust we do not misrepresent him, when we say, that, apparently, the book is primarily intended for sportsmen, and in this respect his book necessarily challenges comparison with the works of such mighty hunters as Selous, Schillings, Gibbons and many others. Such comparison, however, is outside the scope of this magazine, but we may say that his descriptions and stories of big and little game in Portuguese East Africa will be found by all his readers to be exceedingly interesting and instructive ; and the record of his experiences and his advice as to outfit, etc, cannot fail to be most useful to sportsmen. He has many interesting observations to make on the habits, customs, character and language of the natives of these regions, which well deserve the attention of the student of anthropology as well as those whose duty or pleasure induces them to travel or sojourn there. The book is equipped with a useful map, and is adorned with many excellent illustrations.

Un Crépuscule d'Islam. Par ANDRÉ CHEVILLON. Paris : Hachette, 1906. Price 3fr. 50c.

The author describes his tour through Morocco in April 1905, and proves himself a master in observation and word-painting. The *motif* of his work,

however, is to show that Morocco is one of the darkest of the many dark places of Islam. "It has the majesty of a corpse, and at first the artist perceives nothing but this majesty. Before we know the truth we desire ardently that neither the artisans nor locomotives of Europe should come to violate its silence and immemorial tranquillity, and that Fez should never become like the Tangier of to-day, with its Spanish, Jewish, and Marseilles hubbub, its flaring advertisements, and all the vulgar uproar from which the true Mussulmans escape, taking refuge in the memory of past ages and the lofty white peace of their Kasba. I had hoped that in the universal disfigurement of our planet by the civilisation of the industrial type which we call civilisation, this country would remain untouched, and that there would be miraculously perpetuated there a Mussulman Middle Age, with its faith and its original forms, thus dreaming an unfettered dream which no foreign determination could limit. I have ended with the conviction that anything would be better than the present corrupt stagnation. In any case, nothing could be lost, for nothing can be worse than death. This is the present state of Morocco. It is not enough to merely glance at it, for appearances still resemble life. We must look below the surface. We must witness the rapine of viziers, governors, khalifas, amels, and motasibs in connection with the taxes they impose or take off at their pleasure, and which they first get paid in cash and afterwards in body; we must see their extortions by bastinado and the prison; we must note the misery of the masses, and, as a consequence, the prostitution, which is not only universal, but which the authorities encourage because they profit by it; we must observe the male vices, whose signs are conspicuous in the streets; the profound degeneration of bodies, which only look well because they are draped; the state of panic in which the inhabitants of towns periodically live behind their ruined walls; the impotence and chronic disorganisation of the army, the officers stealing the rations of their men, and the men selling their cartridges and rifles to rebels, and deserting whenever they please—to recognise all this corruption we must consult, as I have done, not merely the few Europeans born or some time resident in the country, whether merchants, official agents, officer instructors, or physicians, but Algerian Mussulmans who live at Tangier, El Ksar or Fez, and who never speak of what they see except with a contemptuous smile."

AMERICA.

Camp-Fires in the Canadian Rockies. By WILLIAM T. HORNADAY, Sc.D. London: T. Werner Laurie, 1906. Price 16s. net.

This volume contains the record of a month's holiday in October 1905, spent by Dr. Hornaday, Director of the New York Zoological Park, and some sportsmen friends in a comparatively little known tract of British Columbia, viz., the east Kootenay region, between the Elk River and Bull River. The holiday was devoted for the most part to the pursuit of Mountain Goat and grizzly bears; but the mere slaughter of these animals was by no means the only, or even the principal, object of the expedition. Indeed the sportsmen seem to have voluntarily imposed on themselves limitations, which to many will seem unnecessarily restricted, even if their moderation is pronounced at once commendable and worthy of imitation. For example, devotees of Isaac Walton here will read with mixed feelings, that although Dr. Hornaday carried a rod and reel twenty-five hundred miles for the sake of *one* day's fishing on the Fording River, when the fateful day arrived, he and his two friends deliberately limited their take to fifteen fish, the heaviest of them weighing 2 lbs. 4 oz., on the ground that the party could not eat more in two days, although they were lucky

enough to find the Cut-Throat or Black-Spotted trout taking freely. The particular quarry of which Dr. Hornaday and his friends were in quest was, as we have already said, the mountain goat, of which they secured some very fine specimens now on view in some of the Zoological museums in the United States. The Director also succeeded in getting some fine grizzly bears. But, besides this, one of the party, Mr. Phillips, succeeded in securing some excellent photographs of mountain goats among the wild rocks, which they inhabit, and undoubtedly while getting these photographs, he was again and again in considerable personal danger. Dr. Hornaday claims for the photographs that they represent what he believes "the most daring, and also the most successful, feat in big-game photography ever accomplished," but readers of the well-known work of Mr. Schillings, which we reviewed in the August 1906 number of this magazine, will hardly acquiesce in this estimate. Nevertheless we can cordially admire the extraordinary nerve and endurance on the part of Mr. Phillips, which are abundantly evinced by the photographs and the narrative of this work. Incidentally we learn a great deal about the orography of the tract, and about the habits of the birds and animals which are found there. There are also several short stories, describing exciting incidents and adventures in the sporting career of those who narrate them, which will not fail to amuse and interest the reader. The illustrations by Mr. Phillips are unusually good.

AUSTRALASIA.

Hawaii, Ostmikronesien, und Samoa. Meine zweite Südseereise (1897-99) zum Studium der Atolle und ihrer Bewohner. Von Professor Dr. AUGUSTIN KRÄMER, Marine Oberstabsarzt. Stuttgart: Strecker & Schröder, 1906.

This lavishly illustrated work describes in a masterly manner many of the islands of the inhabitants of Polynesia. The author particularly paid attention to the growth of coral reefs and distinctly states that "an atoll as described by Dana in his *Coral and Coral Islands*, and also in Text Books, viz. a great lake surrounded by an unbroken slender coral ring, does not exist. At all events, it is not typical." He tells how first Semper of Würzburg, then Rein of Bonn, then Sir John Murray, Guppy, and Alexander Agassiz, disproved the subsidence theory of Darwin which Dana upheld.

Professor Krämer likewise investigated the tattooing common among the natives of Polynesia, and figures definite designs followed, being similar to those on mats. Illustrations are given showing natives with their backs wholly tattooed, while others have their arms and others their cheeks and necks. A choir of women sing and beat drums while a man is being tattooed and thus drown his painful cries. Special songs are sung during tattooing, and in them the choir call down from heaven power to the tattooer to do his work artistically. Tattooing is considered in Polynesia the most noble adornment of the human body, and is particularly applied to those parts not covered by clothing.

GENERAL.

Discoveries and Explorations in the Century. By CHARLES G. D. ROBERTS, M.A. Nineteenth Century Series. Edinburgh: W. and R. Chambers, 1906. Price 5s. net.

In this book we have a very compact, and for the most part a clear, account of the knowledge obtained of all parts of the world during the nineteenth century.

The labour entailed by the production of such a volume must have been—as the author says—very considerable, and any one who wants a bird's-eye view of the

geographical discoveries in any part of the globe during the time dealt with, will find it here with sufficient fulness, and the reader or student will find also in this compendium the names of the principal explorers and a brief outline of the work achieved by each.

A bibliography would have been of great use, but it could perhaps be hardly expected in such a volume. Of course in such a compressed account as the scope of this volume admits of there are bound to be omissions, but we think the wonder is that the author has succeeded in getting so much in, not that he has been obliged to leave some out. The perusal of his pages ought to stimulate the student to turn to the older and fuller volumes by the explorers themselves.

BOOKS RECEIVED.

The Tourist's India. By EUSTACE REYNOLDS-BALL, F.R.G.S., F.R.C.I. Demy 8vo. Pp. xii + 355. London: Swan Sonnenschein and Co., Ltd., 1907.

Tra Mex-Afriko: A Travers l'Afrique Centrale. Conférence avec projections donnée au 2^{me} Congrès Universel d'Esperanto à Genève, par LE COMMANDANT LEMAIRE, Ch. Pp. 85. Bruxelles, 1906.

The East and West Indian Mirror; being an account of Joris Van Speilbergen's Voyage Round the World (1614-1617) and the Australian Navigations of Jacob Le Maire. Translated, with Notes and an Introduction, by J. A. J. DE VILLIERS. (Hakluyt Society.) Demy 8vo. Pp. lxi + 272. London, 1906.

A Travers la Banquise du Spitzberg au Cap Philippe, Mai-Août, 1905. Par DUC D'ORLÉANS. Pp. 350. Paris: Plon Nourrit et Cie., 1907.

The Heart of Spain: An Artist's Impressions of Toledo. By STEWART DICK. Crown 8vo. Pp. xv + 155. Price 3s. 6d. net. Edinburgh: T. N. Foulis, 1907.

Uganda by Pen and Camera. By C. W. HATTERSLEY. With a Preface by T. F. VICTORIA BUXTON. Crown 8vo. Pp. xviii. Price 2s. London: Religious Tract Society, 1907.

The Harmsworth Encyclopedia. Vols. VII.-VIII. London: Thomas Nelson and Sons, 1907.

Also the following Reports, etc.:—

The Irrigation of Mesopotamia. By Sir WILLIAM WILLCOCKS, K.C.M.G., F.R.G.S. Pp. 153. Cairo, 1905.

Report on the Administration of Burma for the Year 1905-1906. Rangoon, 1906.

Report on the Administration of Coorg for the Year 1905-1906. Mercaru, 1906.

Rainfall of India. Fifteenth Year, 1905. Calcutta, 1906.

Papers and Reports relating to Minerals and Mining of New Zealand. Wellington, 1906.

Illustrated Handbook to the Perthshire Natural History Museum, and Brief Guide to the Animals, Plants, and Rocks of the County. Second Edition. Pp. 87. Price 3d. Perth: Perthshire Natural History Museum, 1906.

Willing's Press Guide and Advertiser's Directory and Handbook, 1907. Pp. 457. London, W.C.: James Willing, Jun., Ltd., 1907.

Sudan Almanac, 1907. Pp. 67. Price 1s. London, 1907.

Report concerning Canadian Archives for the Year 1905. Vol. II. Ottawa, 1906.

Publishers forwarding books for review will greatly oblige by marking the price in clear figures, especially in the case of foreign books



Photo by Macmahon.

W. M. Ramsay.

THE SCOTTISH GEOGRAPHICAL MAGAZINE.

METEOROLOGICAL RESEARCHES IN THE HIGH ATMOSPHERE.¹

By H.S.H. THE PRINCE OF MONACO.

(With Illustrations.)

METEOROLOGY is a science which is much less advanced than many others. This is due to two principal causes. In the first place, it is only quite recently that it has been the object of experimental research; and, in the second place, the field of this research has been the latitudes of Europe and North America, in the so-called temperate zone, where the conditions are those of transition from the simple conditions obtaining at the Equator to the equally simple, but opposite, conditions obtaining at the Poles. It is a fundamental axiom in scientific research to attack a problem first in its simplest form, and to introduce complications, one at a time. In the case of meteorology the reverse has been the case. The meteorology of Northern Europe, the most complicated and difficult problem in the science, has been attacked first, and the reason of this is obvious, because it was there that the means of attack were first furnished.

The beginnings of meteorology were modest, consisting of isolated observations made by the curious in natural history, with imperfect and often rudimentary instruments; and it was only after these had become more delicate and more precise, and had shown themselves capable of throwing light on the mysteries of the air, that true meteorological observatories came into existence. At first these were confined to the centres of population, but further progress soon made clear the necessity of extending the researches into unpeopled and higher strata, with the result

¹ An Address delivered before the Society in Edinburgh on January 17.

that observatories were installed on the tops of many mountains. About the same time aerostats came accidentally to be used for the same purpose. Finally, in the last few years, the improvements effected in the manufacture of steel have made it possible to fly kites at great heights, carrying self-registering instruments and held by a wire, as light as it is strong. Now, the india-rubber industry renders it possible to send to altitudes hitherto inaccessible by any other means balloons also carrying self-registering meteorological instruments.

The first experimenters who used kites were Americans. Guided by Edy in 1891 and by Rotch in 1894, their instruments attained a height of about 400 and 4000 meters. Shortly afterwards the French Hermite and Bezancon in 1892 launched the first *ballons-sonde*: a much more independent class of instruments which very soon attained heights above the land up to 20,000 meters (65,620 feet). Quite recently the scientific spirit of the Germans, supported by the liberality of the Emperor William, has created at Lindenberg, in Prussia, a magnificent establishment where meteorological researches in the higher regions of the atmosphere are pursued regularly with both systems. These researches are necessarily restricted to the air over the land. There remained the atmosphere over the ocean, a much greater region, and its exploration appeared to be of paramount importance. It was Professor Hergesell of Strasburg, in the year 1904, who first interested me in the subject, and I decided at once to attack it.

In the spring of the same year I was able, after making some alterations in the sounding machine of my ship, the *Princesse Alice*, to use it for sending kites to a height of 4500 meters in the northern region of the trade winds between Portugal and the Canary Islands.

In order that the kite which carries the recording instruments—a combination of barometer, thermometer, and hygrometer, weighing 600 grams, shall ascend to any great height it is necessary to attach to the line or wire a series of kites at intervals varying from 500 to 1500 meters. Each of these, by adding its effort to that of the one which precedes it, contributes to the ascensional force of the system at the moment when the weight of the wire in the air would stop further upward movement. By successive relays it is possible to send a kite with instruments to a very great height, provided that no layers of calm are met with, or if they exist, that the speed of the ship is such that the kite can be towed at a minimum speed of seven meters per second ($15\frac{1}{2}$ miles per hour).

Theoretically, if the dimensions of the kites and the diameter of the wire were progressively increased, it would be possible to reach heights limited only by the rarification of the air. In practice, however, it is found that, owing to the difficulties attending the dispatch of kites on board ship, and the complications which arise from the fact that the upper currents travel in directions which generally vary irregularly from one level to another, a height of 6000 or 7000 meters is the greatest that can be reached. In a recent experiment at Lindenberg, in which the kite reached a height of 6000 meters, it was necessary to veer 17,000 meters of cable, and the final strain on the wire was 85 kilograms.

An experiment, using kites of the Hargrave type, is conducted as follows:—After having made sure that the line which forms the upper section of the flying line has a length of 50 meters, and connects the kite with the wire, exerts a normal and well-balanced strain on the apparatus, and when the velocity of the wind, augmented if necessary by giving a certain speed to the ship, has reached at least seven meters per second, the kite carrying the instruments is hoisted by a line from the mizzen-mast head, and is then allowed to rise gradually and attain a height where the dangerous vortices caused by the ship cease. When the kite sails tranquilly at the end of its line, which is held by several men, whose hands are protected by stout gloves, the masthead block is brought down on deck and the line of the kite is joined to the steel wire, which can then be veered from the steam winch on which it is wound. The same manœuvres have to be repeated as each addition is made to the system.

A girouette,¹ from which the wire quits the ship, carries a dynamometer which indicates the tension of the wire and at the same time performs the function of a regulator of the strains produced by the pitching of the ship or by squalls in the atmosphere.

The kites of the Hargrave type work very well, and the steel wire which I use has a diameter and resistance which gradually increase as more wire is paid out. This is the principle which I apply to my dredging and sounding cables, in order to spare useless weight in the upper section: it is indispensable in kite ascents, in order to attain great heights by lightening the upper section of the wire.

An observer stationed at the girouette conducts the whole operation, communicating with the man at the winch by means of an electric bell. He records regularly by means of the sextant the heights of the kite which carries the instruments, in order to know its position with respect to the ship and to ascertain approximately the influences to which it is exposed in the successive layers through which it passes.

The launching of a kite from a ship is always a delicate operation, and one which demands experience on account of the vortices found in the aerial wake of the ship: of which those visible in the aqueous wake are the image. Often when the apparatus has reached a height where it appears to be out of danger it may be caught by one of these risky vortices and precipitated into the sea. In stormy weather such a catastrophe may occur even after the kite has risen to a height of several hundred meters.

When the wind is strong enough and the bridle (the object of which is to keep the face of the kite to which it is attached horizontal) is not very exactly balanced, the kite at once executes plunging zigzag movements which may produce such a strain as to break the line.

When the kites have reached the greatest altitude permitted by the circumstances, the paying out of the wire is stopped, and, either by increasing the speed of the ship, or by heaving in the wire as quickly as possible, a little final augmentation of height is obtained.

¹ The girouette is a pivoted wheel free to revolve with the wind in any direction.

The recovery of the kites, although somewhat delicate, presents less difficulty than their dispatch. As at the launching of the kite, a subsidiary line is used which is run alongside of the bridle as soon as this is got hold of, so as to limit the motions of the kite.

Unfortunately, even with the greatest care accidents occur. On one occasion, in the neighbourhood of the Canary Islands, the rupture of the wire occasioned the loss of five kites attached to 6000 meters of wire. In a case such as this, the whole system descends until the lowest kite touches the sea. This then acts as a drag, which causes the others to ascend again until a condition of equilibrium is reached, when the whole system drifts in a direction, which is the resultant of the separate impulses received by each kite on the wire. The velocity of this drift has almost always been too great for the kites to be overtaken by my ship. The system has certainly drifted so far and as long as the wind has lasted.

One can imagine the astonishment of the crew of a vessel which meets and gets entangled with such a wire, apparently suspended from a point invisible in space.

It is interesting to note that the curves furnished by our instruments can resist a prolonged immersion without suffering damage when they meet with such an accident. The curve is a line traced by the pen on a layer of lamp-black, deposited on the cylinder by the smoky flame of a petroleum lamp. In a case of immersion the carbonaceous particles disappear, but an excessively thin coating of grease, deposited with the carbon from the flame, remains and the line traced by the point of the pen is clearly visible in it with a magnifying glass.

A notable instance occurred during one of my earliest experiments in the Mediterranean in 1904. An instrument was lost to the northward of Corsica, and was found on the shore of Provence fifteen days later. The curves traced in the greasy film on the recording drum were still perfectly visible, and were utilised with the others in Professor Hergesell's laboratory.

A kite operation, at a height of 3000 or 4000 meters, lasts almost the whole day, and the ship, which must at times steam full speed in order to enable the kites to pass through zones of light wind or of calm, may easily cover a distance of 50 or 60 miles during the operation.

I have made use of these instruments in the investigation of the counter-trade of the northern hemisphere and with the following results. The kites sent to a height of 4500 meters have not furnished any indication which permitted Professor Hergesell to recognise the existence of the counter-trades in the regions explored, although their existence has often been reported by observers. As to the observation of Humboldt of a south-west wind at the summit of the Peak of Tenerife, it is to be explained in another manner. If one observes, as I did in the summer of 1904, what takes place among the Canary Islands during the season of the trade winds, one sees sometimes that the region of the sea, which lies to the southward of the higher islands, as far as a distance of 20 or 30 miles from their coast, is swept by a strong south-westerly wind. According to Professor Hergesell, this wind is due to a purely

local cause. The southern slopes of these islands, bearing little vegetation, exposed to the rays of a powerful sun and sheltered from the trade wind, produce a dilatation of the atmosphere in the neighbourhood, which rises along the slopes and overflows at the summit, overcoming and, to a certain extent, reversing the trade wind. Humboldt and others have been led by this phenomenon to believe that they were in presence of the counter-trade.

It would not occur to any one to pretend that the counter-trade does not exist. The masses of air drawn into the tropical regions by the trade winds of both hemispheres, must regain the regions abandoned by them, but the path which they follow is still unexplored.

After a season's work with kites in the Atlantic, I resolved to apply to the meteorological research of the atmosphere at great altitudes above the ocean, the system of *ballons-sonde* which had already been giving excellent results on the continents. With the assistance of Professor Hergesell I made several tentative experiments in the Mediterranean in the spring of 1905, chiefly with the view of making myself familiar with the difficulties which such operations present, and especially with reference to the recovery of the balloon when it has descended again on the sea. The final method of procedure was the following.

Two very light india-rubber balloons were inflated, one to a slightly greater extent than the other, with hydrogen of which a supply was carried in steel cylinders. The less inflated balloon carried the registering instrument, enclosed in a small basket, an instrument analogous to that used with the kites, but more complete, as well as a float suspended at the end of a line 50 meters long. The more inflated balloon was connected with the other by a line also 50 meters in length. Its function was, first, to facilitate the ascent by rendering the necessary assistance to the other balloon and, afterwards, to facilitate its descent with the registering instrument by quitting it at the altitude determined beforehand by the degree of inflation given, on which depends the height at which the balloon burst. The first balloon, now become a simple parachute, brought the instrument back towards the sea, above which it remained floating so soon as the float at the end of the stray line touched the surface of the water. In this way, the basket containing the instrument was kept clear of the waves, and the balloon remained visible at a distance of 8 to 10 miles. During the ascent it was necessary to make observations as often as possible with the sextant and the compass so as to fix the altitude and azimuth of the balloons at different instants with a view to establishing the route followed through the air, and thus to obtain the elements for arriving at a knowledge of the strength and direction of the aerial currents in the different layers traversed. It must be understood that the ship was following the system at full speed, in order not to lose sight of it, a result which was obtained, thanks not only to the excellent prismatic glasses used, but also to the keenness of sight of some of the observers. An operation of this kind was possible only in very clear weather, because the disappearance of the balloons behind a cloud would have made very doubtful the discovery of the place where they fell.



FIG. 1.—Filling the balloon and stopping up small holes.

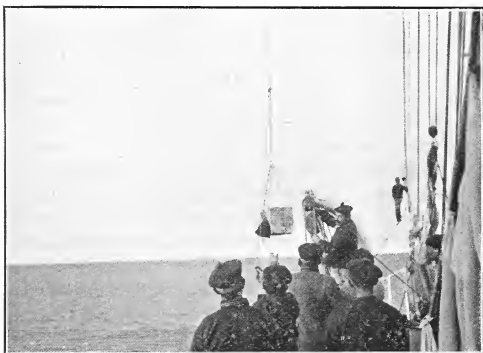


FIG. 2.—The instruments coming safely on board.

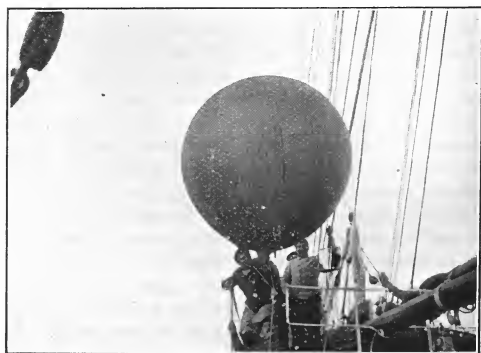


FIG. 3.—End of the experiment, the balloon returning on board with the baskets for the instruments.

A BALLOON EXPERIMENT.

In these conditions I made a cruise of 5500 miles in 1905 in the Atlantic, during which eighteen experiments were made with balloons up to a height of 14,000 meters, of which most were successful, and confirmed the conclusion of the previous year with regard to the counter trade-wind, arrived at with kites used at lesser elevations.

But this method presented various grave difficulties; first, the recovery of the balloon if it had been sent to a great height, and second, the exact fixation of the point where the ascent of the balloon would be stopped by the bursting of the subsidiary balloon. In fact, any fault in the india-rubber of which the balloon was made might advance or retard the time of explosion. From the year 1905 we have sought to remedy these difficulties, and have succeeded as follows.

In the first place, we can now recover the balloon with its instrument, no matter what may be the distance of the point where it reaches the sea. Relying on the fact that, from its culminating point down to the surface of the sea, the system passes through meteorological conditions which are sensibly similar to those which it had met with during its ascent, we have established a formula which permits us, if we have followed the balloons during the greater part of their ascent, to trace rapidly on the chart the route which the *ballon parachute* will follow during its descent, and consequently, the point of the sea where it will fall. The ship can now be steered for this point without the necessity of following the balloon. Our formula has afforded us the means of finding the balloon on all occasions when its course has not been disturbed by accidental causes. We made the first successful use of the formula in the summer of 1905.

In the second place, we can now arrest the ascent of the balloons at the desired height. The bursting of the subsidiary balloon is no longer used on my ship for this purpose. It presents some irregularities, which however do not affect the validity of the results obtained, because the barometer indicates with precision the altitudes traversed. The subsidiary balloon is now detached from the system altogether at the desired height by the action of the electric current furnished by a small dry cell on a spring, which takes effect the moment the pen of the recording barometer touches a conductor set for the desired altitude. In order to be sure that the cell will act at the great altitudes where the cold is intense, it is surrounded by a calorific envelope, which does not require to be very powerful, because the balloons, having a velocity of ascent of 300 meters per minute, attain these heights very rapidly. We made the first application of this method in 1905.

But the *ballons-sonde* are not the only apparatus which we have employed, along with kites, for investigating the phenomena of which the high atmosphere is the seat. In certain circumstances, for instance, when the sky is covered with clouds, or if the vicinity of inhospitable land makes it unlikely that balloons would be recovered, we have used captive balloons, sent to moderate heights. A *ballon-sonde* was fixed to the end of the very light wire of the kites, and when it had reached the greatest elevation which its ascensional force, diminished by the weight of the wire, permitted, a second balloon was allowed to slip up

along the wire which, when it arrived near the first, gave the system a fresh charge of ascensional force and permitted it to rise higher. In this way we sent a group of three or four balloons, selected from those which had served as *ballons-sonde*. Having already been exposed to very great dilatation in the high atmosphere, it was not thought safe to use them for this purpose again. The recording instrument was attached to the last balloon, which could then ascend along the wire with a velocity sufficient to afford adequate ventilation for the thermometer. In this connection I may observe that the use of *ballons-sonde* offers very considerable advantages over that of the kites, by the exactness of the temperatures registered, which is due to the ventilation which the thermometer, placed in a sort of chimney, receives during the ascent. The ascent also is effected at a much higher speed.

We have also launched pilot balloons, which sever all connection with those who dispatch them. They rise to prodigious heights and disappear for ever. They carry no instruments, but they furnish valuable information regarding the direction and the violence of the aerial currents in the highest regions of the atmosphere. The following is the manner of their employment.

The weather being clear and otherwise favourable, three observers, —forming a triple alliance—land on the shore of a continent or of an island. They take with them a small balloon inflated to a diameter of not more than one meter, and a theodolite, the telescope of which is especially powerful. The balloon may, however, be retained on board to be launched at a given signal from the shore.

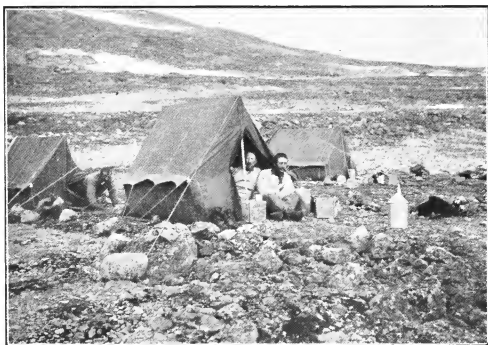
The theodolite used by Professor Hergesell, if established on solid ground, permits the observer to follow the balloon without losing sight of it, whilst his two assistants read and note, every half minute, the angles furnished.

Finally, in 1906, we have attempted, and with success, a third method which allows a certain amount of exploration of the atmosphere, notwithstanding the presence of clouds, but with a clear horizon. It is then necessary to furnish the balloon with means capable only of taking it to such an altitude that it can regain the surface of the sea at a distance which does not exceed the limits of visibility. The ship is then stopped on the spot where the balloon was started, and attentive observers watch all directions in order to detect its return from above the clouds. The only experiment of this kind which we have made, succeeded perfectly, and the balloon, which had reached a height of 4800 meters on a day when the sky was completely covered by very low clouds, was detected and recovered at a distance of twelve miles.

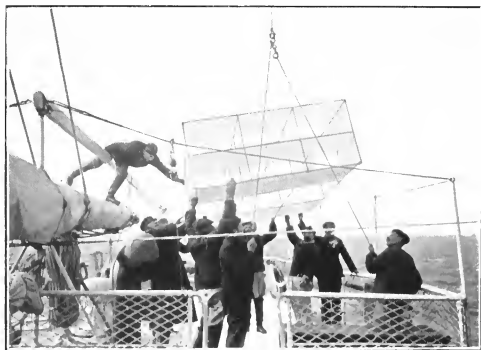
Now, what results have been furnished by this new use of balloons over the sea? It is, after the first exploration made with them in the region of the trade winds during the cruise of 1905, towards the high atmosphere of the arctic regions that I have carried on my investigations to increase these results. I therefore took measures, in concert with Professor Hergesell, so as to be able to make the best use of the opportunities offered by my cruise of 1906. The balloons, the instruments,



Terminal ice-face of a Spitsbergen glacier.



Norwegian party's camp on Spitsbergen—Captain Isachsen and Dr. Louet in their tent.



Flying a kite.

and the methods afforded a better guarantee of successful results than in 1905.

But I was much hampered in the execution of one part of my programme by the persistent fogs over the sea to the westward of Spitsbergen, although in the bays and on land the weather was magnificent. Thus the dispatch of *ballons-sonde* which the preliminary experiments in the Mediterranean had rendered perfect of execution was stopped by this unsurmountable difficulty. Twice only was it possible to dispatch them. Nevertheless the information received is not without value, since our registering instruments have brought back curves from an altitude of 7500 meters in latitude $78^{\circ} 55' N$.

In presence of continual fog at sea and the impossibility of launching usefully *ballons-sonde* in the neighbourhood of inhabited lands, we have frequently employed our *ballons-sonde* as captive balloons, as I have already explained.

But our best results have been realised with pilot balloons: these instruments, which are small enough to be embraced by the arms of a man, have been followed with a special theodolite to the extraordinary altitude of 29,800 meters (97,700 ft.), if it is assumed that their velocity of ascent increased a little with the change of density of the atmosphere in the most elevated regions; or at the very least to an altitude of 25,000 meters (82,000 ft.). Further, the one which attained this height was, at the moment of its disappearance, at a distance of 80 kilometers ($49\frac{1}{2}$ miles) from the observers. So remarkable a result is explained by the transparency of the atmosphere in the Arctic regions, a transparency which under other circumstances permitted us to follow distinctly on the snow of a glacier, at a distance of 40 kilometers, the movements of a party of four persons whom I had sent on a mission of exploration in the interior of Spitsbergen.

The information furnished by the pilot balloons which carry no instrument because they are sacrificed, concerns questions of capital importance for meteorology; the direction and the velocity of the upper currents. Now our pilot balloons of 1906 have taught us that there exists in the Arctic regions in the neighbourhood of the 80th parallel, at a height of about 13,600 meters, certain winds of 60 meters per second (132 miles per hour), a force for which we have no equivalent at the surface of the globe. Their direction was $S. 68^{\circ} W$.

The theodolite which we employ permits the two assistants of the one who observes the balloon while keeping it continually in the axis of the telescope to note at every moment its position in space, its altitude as well as its path, and the velocity of the currents which it traverses from its departure to its disappearance.

We made thirty explorations of the high atmosphere in the arctic region of Spitsbergen in 1906, and twenty-six in the Atlantic ocean or in the Mediterranean in 1905; and the results of these cruises show that if the principal states of the world were willing to diminish a little the expense of international quarrels by submitting them to the judgment of a tribunal less costly than that of war, and if they preserved more of their resources for the veritable interests of humanity, it would be

possible with powerful means, very soon to ascertain the laws of meteorology, the key of which seems to be found in the higher atmospheric regions. It remains only to add that Germany has just sent to the Atlantic and the Indian oceans a special ship, the *Planet*, to continue and extend my aerial explorations. On the other hand, Messrs. Teisserenc de Bort and Rotch have fitted out and used during 1905 and 1906 a ship of their own for this purpose.

I am also very pleased to mention the share taken in my three Arctic expeditions by one of your Scottish meteorologists who has become a distinguished oceanographer, Mr. W. S. Bruce, the leader of your fine Antarctic expedition of the *Scotia*, one of the most fruitful of those which have explored that region in the last few years, and one whose success is the more pleasing to your country because it was carried out at very moderate financial expense. It is to be hoped that the future will permit him to continue his scientific work. This year Mr. Bruce again accompanied me with two assistants to the Arctic regions to undertake the exploration of a large island off Spitsbergen, Prince Charles Foreland. He carried this work out under weather conditions as unfavourable for the work of survey as for navigation.

THE TRANSITION OF BRITISH AFRICA.¹

By Major A. ST. H. GIBBONS, F.R.G.S.

(*With Illustrations.*)

My first endeavour this evening will be to give a general description of natural Africa as it appears to the eye of the average observer travelling from the extreme south of the continent to Egypt. By recalling points and places of interest as they appeared to me, I shall hope to convey a tolerably accurate impression of each successive district traversed, the more obvious physical and climatic changes noticeable as the journey progresses, as well as any casual point of interest that may occur. Since impressions acquired, as well as impressions conveyed, are so largely subject to modification or exaggeration in proportion to the degree of imagination influencing all the temperaments concerned, I cannot hope to be universally successful in this respect, but where I fail the photographs you will be shown will to some extent have a corrective influence. On arrival in Egypt we will pass on to a discussion on the British Colonies and Protectorates of Africa, most of which lie on the route we follow.

The Cape Peninsula, with its congenial climate, productive soil, and picturesque scenery, takes a high place amongst the more favoured spots of this world. The visitor driving through the suburbs cannot fail to be impressed by the noble avenues of oaks, which in height at least would dwarf their sires of Europe if placed side by side with them, or by the extensive plantations of firs and pines from many parts of the world which grace the slopes of Table Mountain, a perfecting touch

¹ An Address delivered before the Society in Edinburgh on December 12, 1906.



Scottish party leaving *Princesse Alice* for Prince Charles Foreland.



Scottish Assistants.

Norwegian Assistants.

A. Fahrmeister.	A. Fabrienta.	L. Tinayre.		H.S.H.	Lieut. Staxerud.
Captain	Dr. Richard.	Dr. Louet.	Capt.	The Prince	W. S. Bruce.
Bourée.	Dr. Portier.	Prof. Hergesell.	Isachsen.	of Monaco.	Capt. Carr.

added by man, but unthought of by nature when she created one of the grandest and most beautiful monuments of scenery to be found all the world over. The indigenous tree-growth of the Peninsula is both sparse and scrubby, but it is a remarkable fact that when replaced by imported stock these thrive much more luxuriantly than in their native soil. The older trees, especially the oaks, owe their existence to the Dutch governments of the seventeenth and eighteenth centuries. With admirable forethought an "arbor day" was instituted, on successive anniversaries of which each colonist was by law required to plant at least one tree for himself and one for each member of his family.

Both soil and climate are particularly well adapted to the cultivation of the grape. The government takes a leading interest in the wine industry, and at Constantia, formerly the official seat of the Dutch governors, the grape is produced and wine made under the best expert supervision. If all wine grown at the Cape was up to the government sample, the attempt made to introduce Cape wines into England a few years ago would not have failed. Fruit has been grown for many generations, but it was not until the early nineties that high-class fruit was introduced. Pears and stone fruits of the very best quality are now being successfully cultivated in ever-increasing quantities.

Leaving Cape Town by rail, a few hours introduces the traveller to the bold, rugged scenery of the Hex River Mountains. These rise in what appears to be a long range extending out of view to east and west. In reality these mountains, which are about 4000 feet in altitude, form the escarpment of the great plateau which stretches northwards through the heart of the continent to within a short march of the Victoria Nile, where it falls away to the level of the Upper Nile basin in two escarpments. The Hex River Mountains, as one would expect, separate two very different climates. To the south rains fall practically in the winter months only. At this season on the plateau a bright, clear sky, almost without a cloud, is the invariable rule. In June and July night frosts are severe, and I have known snow to lie in some of the higher altitudes for several days. In September—the early spring—the wet season is heralded by occasional heavy thunderstorms, which increase in frequency as the summer progresses. As far as the neighbourhood of the Orange River this plateau land is remarkable for the almost total absence of grass, but a very useful substitute exists in the growth of the little karroo bush, a small plant not unlike some heathers in appearance, which rivals the best sheep pastures in the world. Barren and monotonous to the eye as the karroo veldt is throughout the winter months, it responds to the first September rains with remarkable suddenness, when its young green shoots, mingling with many-coloured wildflowers, convert it into a great natural carpet of delicate tints.

In Griqualand West and Bechuanaland proper the Karroo is replaced by undulating grass downs, and here sheep give place to cattle. Until three miles beyond Mafeking scarce anything arboreal more shady or imposing than our own gooseberry bush is to be seen. At one time stunted acacias were not uncommon between Vryburg and Kimberley, but these rapidly disappeared before the demand for wood in the early

life of the latter town. From this point, however, forest in one form or another is general, and plain land quite the exception, to within a short distance of Khartum. In Bechuanaland the soil is largely of a red laterite. This covers a far greater area of the plateau land of Africa than all other soils. In South Africa it is patchy, as it is north of the Zambezi until within a couple of degrees of the Congo-Zambezi watershed, from which point it is general right throughout the high ground of the Congo Free State, British and German East Africa, as well as Uganda. The savannah forest of the Bechuanaland Protectorate is mainly composed of acacias of different varieties, but in the north, where the red soil gives place to a yellow loam, as also in the yellow sand of the Kalahari, considerable patches of mopani are encountered. This tree, the leaves of which when viewed from a short distance remind one of the English beech, and which like the beech retains many dried leaves after the green shoots have burst, is a hard, useful wood, the red heart of which is rendered especially valuable on account of its being impervious to the ravages of the white ant. The Bechuanaland Protectorate is the poorest province of British Africa through which my wanderings have led me. It is true that cattle do well in certain districts, but even then a wide acreage is necessary to support a small herd. The rainfall is small and uncertain, and there is evidence that it is less than it was twenty-five years ago. Droughts are of frequent occurrence.

Next we enter the Kalahari Desert. Though the rainfall is even less than in the Protectorate, averaging only six or seven inches, the Kalahari is misnamed a desert. The sandy undulations are covered with savannah forest and a fair admixture of good cattle pasture. "Wilderness" is a more appropriate descriptive term in this case, and such it will remain until the population of South Africa has so far increased as to extend the margin of cultivation to such a country as this, where the absence of surface water can only be made good by tapping the hidden reservoirs below ground. So porous is the sandy soil of this great wilderness, that so great a river as the Okovango, which in 19° S. lat. is a strong, deep stream two or three hundred yards wide, and at flood time inundates a valley 20 miles broad with an average of quite 3 feet of water, is 60 miles further little more than a trickling stream, and in the dry season disappears altogether. That this was not always so is proved by the existence of beds leading to Lake Ngami which could not have been created under present conditions. The rivers which fed the lake when Livingstone discovered it could not have been larger before entering the sand area than they are to-day. Yet then Ngami was a wide stretch of water extending beyond view, while ten years ago it was but a small reed swamp. It is said that the lake within the last few years has shown signs of refilling. The eastern confines of the Kalahari and the western boundary of Matabeleland are conterminous, and here the conditions alter for the better, the country becoming for the most part undulating, well-watered plateau. More striking, however, is the change experienced on crossing the Zambezi, the watershed of which, lying only a few miles south of the river, marks the northern limit of the Kalahari. After toiling for five weeks through deep sand,

under conditions which make a twelve-mile day's journey a most satisfactory performance, it can be imagined with what feelings of exhilaration the eyes first rest on that noble stream of clear, deep water. Here we are on the threshold of Central Africa, and enter a sub-tropical country differing from South Africa in many of its characteristics. The natives are quite distinct, vegetation has undergone a considerable change, and the shadeless, thorny acacia is replaced by comely trees from 25 to 40 feet high, according to the district in which they grow. The northern Zambezi's affluents, and even their small tributaries in the upper river basin, *i.e.* those entering above the Victoria Falls, unlike those in South Africa, carry water throughout the year. The Zambezi also forms a limit to the habitat of several species of game. The giraffe, the ostrich, the tsessebe, the gemsbuck, the South African waterbuck, and the red hartebeest, though found in some cases in large numbers near the right bank, are unknown on the left. On the other hand Crawshay's waterbuck and Lichenstein's hartebeest are only found beyond the Zambezi, while the Pookoo, Lechwe, and Situtunga, being river animals and consequently not limited by water boundaries, are found on the western tributaries, and have followed the Okovango to Lake Ngami. These are very common to the north and east of the river, and essentially belong to that country. The soil of the Upper Zambezi basin is, I believe, peculiar to itself. It is a white, large-grained sand, which, when washed clear of alluvium, is snowlike in appearance. Everlasting undulations of it extend from about $17^{\circ} 30'$ to 12° S. lat., and, roughly speaking, from the western water-parting of the Kafue system to beyond the Kwito. This practically embraces the whole of the Upper Zambezi basin, lying above 3000 and below 4000 feet in altitude, as well as that of the Okovango, which, on evidence I published five years ago, seems to have been part of the Zambezi system not many centuries past. Just as the Barotse Plain, which undoubtedly was once the basin of a large lake, was



Fig. 1.—The *Constance*, the first steamer placed on the Zambezi between the Kebrabasa Rapids and the Victoria Falls.

drained dry by the erosive action of its water on the confining hills below the Gonye Falls, so is there evidence that at a still earlier period the whole of this white sand area was the site of a great freshwater inland sea, until centuries of erosion had gradually eaten a way through the mountainous region extending for over 100 miles eastwards from the Victoria Falls, and in doing so created the series of narrow rocky gorges

through which the river passes to-day. The Batoka Plateau on the east, and the southern slopes on the long ridge which divides the Congo and Zambezi systems, is the commencement of the great northern expanse of red loam alluded to above. From the west of the line of the great mountain region stretching from Lake Mweru to Lake Albert until the dense forests in the centre of the Congo basin are reached, the general character of the vegetation varies but little from that of Barotse-land. The same undulating ground continues, and the same class of tree is found on all sides. The journey northwards from Mweru to Tanganyika, and thence through Kivu, Albert Edward, and Victoria to Albert, is particularly interesting. Of these lakes, three at least are victims of the same gradual erosive action which in centuries gone by deprived the Zambezi of its great lakes. Before the narrow Luapula outlet from Lake Mweru had commenced to eat away the rocks at the base of the valley through which it flows, the lake must have been at least four times its present area, and at a still earlier period was probably one with Lake Bengueulu. On Tanganyika the palm-tree to which, according to native report, Livingstone tied his boat on his journey up the lake, now stands nearly a quarter of a mile from the shore, in the gardens of the Jesuit Mission Station at M'pala, and, so far as I could judge, 25 feet above water-level. This gives an annual lowering of 10 inches in the lake surface. The Lukugu outlet, through which I subsequently waded knee-deep, passes over a sand-bar, beyond which there is a steep decline, so we may expect the same lowering process to continue until the bed-rock is reached. Kivu, by thousands of years the youngest of all these lakes, seems to have remained much the same in this respect as on the day when water first filled the great basin erected by one of the earth's mightiest upheavals. On the other hand Albert Edward, where the Semliki leaves it, has been subject to an influence similar to that exerted on Mweru. In general appearance each lake has its charm, and each is in character distinct from the rest. Mweru leaves on the mind an impression of peace. The southern shores are low-lying and reed-girt, but gradually these give place to wooded undulations, and later to larger hills sloping to the water's edge. The north, like the south, lies low, but is more gravelly and consequently less swampy. "Grand" is the word that best describes Tanganyika, with its great mountain ranges rising to many thousand feet skywards. Kivu is perhaps the gem of all, with a water surface 4900 feet above the sea-level; its serrated shores, as well as those of the large island of Kwijwi, rise in steep slopes, which on the mainland are finally merged in the great mountains behind. The land is rich and open, the air fresh and bracing. It is said that this district contains no malarial microbes, and certainly the water harbours neither hippopotami nor crocodile. It is the one large piece of African water into which one can plunge with perfect equanimity.

Albert Edward has a certain charm of its own. Though the approach from the south into the reed-begirt swamps that bound the lake gives the traveller an unfavourable first impression, as these uncongenial surroundings are replaced by the mountainous walls of the north and west and the wooded undulations of the north-east, his earlier

disappointment vanishes. The water of the lake is slightly brackish and of a yellowish tinge, but is not undrinkable. The southern extremity forms a rendezvous for innumerable hippopotami, which find an ideal feeding ground close by. Lake Albert, extending as it does from the base of the Ruwenzori Range—the Mountains of the Moon—and bordering the Toru and Unyoro plateau, which falls from over 4000 to 2400 feet into the lake itself, is a noble and well-favoured stretch of water. Compared with Tanganyika it might be said that Lake Albert is more picturesque than grand.

Lastly we have Lake Victoria, which, though not so long as Tanganyika, has a greater superficial area, and by virtue of its more basin-like shape is the only one of the six lakes referred to which can be accurately described as an inland sea. On Victoria alone is it possible to be in such a position as to be quite out of sight of land even on a clear day. The shores of the lake, with its innumerable bays, trees growing to the water's edge, and an undulating background, are very beautiful in places and are sometimes lashed by sealike waves, a characteristic which Victoria shares with Tanganyika, as I once learned very nearly at the cost of my life.

From Nyasa there is, as is well known, a valley extending along the line of the great lakes. As one passes northwards there is daily evidence in both soil and other physical features of the volcanic origin of this great lake district, and between Tanganyika and Albert Edward this is particularly evident, especially to the north of Kivu, where the lava from a recent eruption of one of the Umfumbira mountains still lies black and bare over what within the memory of living natives was inhabited forest-land. The tree-growth between Tanganyika and Kivu is stunted and scant. In the bed of the valley the thorny shadeless acacia and the stiff symmetrical euphorbia are alone seen, while to the north of Kivu the valley is practically treeless until within a few miles of Lake Albert Edward a savannah, which smacks of South Africa, is encountered. The downs round Kivu and on the plateau of Toru are covered with elephant grass which stands far above the height of man, and through which progress would be almost impossible were it not for cleared paths. Unyoro, the district which lies in the angle formed by the eastern banks of Lake Albert and the Victoria Nile, is identical in character with the Bechuanaland Protectorate, as is the neighbourhood of the Upper Nile beyond the swamps of that pestilential and unprepossessing section of the great river which lower down is so profoundly interesting and useful. The same class of vegetation reaches to within a few miles of Khartum, where it is replaced by the grassless dry desert of Egypt. Not only are these northern latitudes similar to the south, although separated by 2000 miles of very different country, but there is also a striking resemblance between much of the fauna of these two extremities of the continent. The Giraffe, whose habitat in the south is limited to the Zambezi, once more appears here, as does the Secretary Bird. In the north and south the Ostrich is identical, though a different species appears in the intermediate area. Except in colour the red hartebeest of Khama's country closely resembles Jackson's hartebeest of Unyoro and

neighbourhood, and the White Rhinoceros (which until I secured his counterpart on the Nile six years ago, was not known north of the Zambezi) apparently does not exist in the intermediate area. Many of the smaller birds seemed to take my mind back to South Africa, though, as I shot nothing not required for food, I can only record this fact as an impression.

Such in the main is a general summary of impressions which occur to the ordinary observer taking a walk from one end of Africa to the other. Up to 1890, and even later, his observations would have been limited to the Africa described—the Africa of all past ages—for where his footsteps were not implanted on absolutely unexplored territory, such Europeans as had preceded him were occasional wanderers like himself who had come and gone away again.

Now—only sixteen years later—how changed is the whole aspect of the Continent! This grand sanctuary of nature is being rapidly transformed. European ideas, experiments, and methods are permeating the most remote regions. In Europe one has heard much cant on the lines of the substitution for barbarism of the blessings of civilisation. In Africa the curses of our vaunted social progress seem in places to loom so large as to almost obscure its loftier attributes. In pondering over the respect and simple hospitality of which one was wont to be the recipient at the hands of the inhabitants of the most inaccessible districts—especially those that had never previously known a European—I have wondered what those natives now think of the white man and his methods!

But amidst all this confusion of ideas my mind reverts with pride to the recollection of how on more than one occasion foes became friends on discovering my British nationality—for from Britishers all natives expect and usually obtain fair play.

To the same cause do I attribute the comparative ease with which I have been able to cover long distances—occasionally through districts by no means peaceably inclined towards Europeans generally. Since the days of the great pioneer of modern African exploration, of whom Scotsmen are so justly proud, I believe I may claim to be the first traveller who has never had an askari or armed native in his employ. My caravans have seldom exceeded twenty in number, and on no single night has a watch been kept over my camp; and yet in some countries through which I have passed the European officials will not leave their stations without armed escort.

Yet another memory rises before me. Early in 1900 I entered Uganda after nearly two years of daily marching. Since quitting British territory in the south I had grown so accustomed to the sight of women and children flying on my approach, that the sense of security evinced by the natives of the Protectorate, and the respectful manner in which both sexes stood aside and saluted as I passed on, were especially gratifying to my British pride.

Such experiences suggest, if they do not prove, that no matter how disappointing the existing process of civilising Africa may be, our own system—and what is still more important, the spirit in which effect is

given to it—is at least sympathetically considerate of the rights and interests of the weaker races.

Of African Crown Colonies and Protectorates, *i.e.* of British possessions in the earlier stages of development—there are three great groups—west, east, and south central. With the exception of very small possessions on the West Coast; a flimsy Foreign Office Protectorate over part of Somaliland proclaimed in 1884; and the granting at the end of 1888 of a Royal Charter affecting certain territories in East Africa leased from the Sultan of Zanzibar, the whole of this new soil, amounting in the aggregate to over 2,000,000 square miles, has been broken since 1890. By the annexation in 1902 of the Transvaal and Orange River Colonies a further 167,000 square miles fell under British control.

Though my travels have given me some experience of every other colony in British Africa, they have never led me into the West Coast group. I will therefore content myself here by merely giving one or two historical and economic facts bearing on their prospects as a whole.

The West African Colonies cannot, as is well known, be accurately described as health resorts, though the new acquisitions, lying as they do well back from the coastline, are by no means as unhealthy as the term "West Coast" implies. In places the land rises to eight or nine hundred feet above the sea-level, which though far below the altitude necessary to convert the tropics into a climate suitable for European colonisation in the sense of permanent settlement under conditions of family life, is none the less sufficiently high to ensure the existence of well-drained and open sites for government and other stations.

The first active attempt made by England to establish a footing in Africa took place as early as the year 1618, when English merchants, having failed to open the Gambia to their trade, landed on the Gold Coast and there erected a fort. This was the first of several forts and trading stations and of a growing trade. A trading company obtained a charter in 1662, to be succeeded ten years later by the Royal African Company, and this in 1750 gave place to the African Company of Merchants, which by Act of Parliament obtained more extended rights. In 1821 the settlements of the Gold Coast were taken over by the Crown and placed under the administration of Sierra Leone. In 1874 the Crown Colony of the Gold Coast was constituted as a separate administration. Until 1872 the Dutch retained certain territorial and trading rights, but were bought out in that year, the Dutch having withdrawn twenty-two years earlier.

In Gambia the first English fort was built on an island in the estuary of that river in 1686. The subsequent century was distinguished by a keen commercial struggle between the Portuguese, the French, and ourselves, and it was not until 1783 that, by the Treaty of Versailles, British sovereignty was secured over the islands in the estuary and a small mileage on the mainland. In the earlier part of the seventeenth century the Gold Coast and Gambia derived their chief commercial importance as slave-collecting depots from which the plantations of America and the West Indies were largely supplied. With the crusade of Wilberforce a generous reaction in feeling took possession of

the people of these islands, and many thousands of slaves were liberated. In 1787 Sierra Leone was acquired by arrangement with native chiefs for the express purpose of supplying a free home on their native continent for the very slaves we had been so active until recently in forcibly deporting across the seas. The result is that Sierra Leone has become a polyglot little black colony, of which about 45,000 of the inhabitants are descended from liberated slaves gathered from different parts of the continent, as against 30,000 local natives.

Among these earlier colonies we must also include Lagos, which lies between Southern Nigeria and French territory. These, with small interests in the neighbourhood of the Lower Niger, represent British territorial rights as inherited from earlier generations of Englishmen. For a century our territorial possessions on the coast had ranged between 10,000 to 15,000 square miles, and it was not until a very few years ago that we commenced to realise that, if we did not look after our interests with intelligence and activity, our prosperous little West Coast Colonies would be deprived of the free exercise of trade with the interior. Even then, as in so many parallel cases, the situation was not to be saved by the elected representatives of the nation, but by the individual and collective foresight of a chartered company under the direction of great administrative ability. Commercially so successful, and politically so active was the Royal Niger Company under the direction of Sir George T. Goldie, that when the government bought out the company in 1900 the direct effect of thirteen years' work was that upwards of 300,000 square miles had been acquired for the Empire, and scope for future prosperity was assured. The material position of these colonies is most satisfactory, for, with the exception of the newly acquired territories of Northern Nigeria, each colony not only pays its own way, but steadily improves its position from year to year. Southern Nigeria, formerly the heart of the Royal Niger Company, already heads the list, partly no doubt owing to the business-like organisation inherited from the Company, and partly through having the run in Northern Nigeria of an extensive British Hinterland. Southern Nigeria was this year wisely amalgamated with Lagos for administrative purposes.

The total revenue of all these colonies was :—

In 1900	£1,143,473
In 1904	1,937,329
Increase of	793,856

	TOTAL IMPORTS.	IMPORTS FROM UNITED KINGDOM.
1900	£4,258,477	£3,070,021
1904	5,790,088	5,120,589
Increase of	1,531,611	2,050,568

	TOTAL EXPORTS.	EXPORTS TO UNITED KINGDOM.
1900	£3,868,710	£1,778,727
1904	5,067,228	2,449,169
Increase of	1,198,516	670,442

Among the produce exported from the coast are rubber, beeswax, palm oil and kernels, gold, ivory, skins, ginger, gum-copal and ebony.

Just as the Royal Charter in 1887 intrusted the Royal Niger Company with the exercise of sovereign rights with results so satisfactory both from an Imperial and commercial standpoint, so in the following year a charter granted to Sir William Mackinnon and his co-directors was destined to increase the area of the British Empire by a further million of square miles, of which a large portion is capable of useful economic development. The Imperial British East African Company acquired its first territorial rights by lease from the Sultan of Zanzibar, and later supplemented these by means of treaties with native chiefs in the interior. The most important inland territories affected was the native kingdom of Uganda, in which the work of administration commenced in 1890.

Unfortunately the Company was not a commercial success. In 1893 the Imperial Government took over the administration of Uganda, to which were added in 1894-95 the districts of Unyoro, Usoga, Nandi and Kavirondo. In 1895 the remainder of the Company's territory was placed under the control of the Foreign Office, this latter to be administered by the Zanzibar Consul-General as Commissioner of what had now become the British East Africa Protectorate, the former under a separate Commissioner being already known as the Uganda Protectorate. In 1902 Naivasha and Kisumu, the latter of which includes the Nandi country, were transferred to the East African administration.

Thus the British East African Company died in its infancy, but like the proverbial grain of seed wheat its short existence will, I feel sure, prove to have been the germ of a great economic development, and it certainly was the direct means of opening out to future British settlement one of the healthiest and most interesting plateau-lands of the world. When I visited East Africa two years ago, I confess I was not impressed by the progress so promising a country had made during the first fifteen years of its existence under British administration, whereas in Uganda at the commencement of 1900 the net result of a decade of Foreign Office rule seemed to be the introduction into the country of a few officials and missionaries, who appeared to have played their part with every credit to themselves as organisers in the one case and educators in the other (for the bearing and conduct of the natives were such as are only to be found under administrations conducted on high principles). But trade and industry, which are the *raison d'être* of the acquirement of colonial possessions, were as a principle—and I contend as a *bad* principle—not only discouraged, but practically prohibited so far as British settlers were concerned. The effect of this was that necessary trade was in the hands of a few Indians, and enterprising Germans domiciled in German East Africa, while the Englishman who wished to acquire interests in the Protectorate, even when his claims were locally supported, was told that the Foreign Office did not consider that the country was yet ripe for settlement. To one whose earliest experience had fallen in the south the policy thus proclaimed seemed a strange one indeed, for surely from the very moment property

and the person can be declared safe, the trader and settler should be encouraged, and the government should at once turn its active attention towards the development of trade routes and cheap lines of communication. Uganda was booming in those days under the direction of a progressive and able administrator—Sir Harry Johnston, one of your gold-medallists. When a country is what is termed “before the public” pioneer settlers are always forthcoming. Uganda in due course fell asleep under more placid auspices, and still sleeps. An opportunity was lost. There is no longer any manifest desire among pioneer settlers to try their luck in Uganda. They go elsewhere.

In 1892 a preliminary survey for a railway to connect Mombasa with Lake Victoria was commenced, the government having wisely recognised the strategic importance of such a railway in view of certain

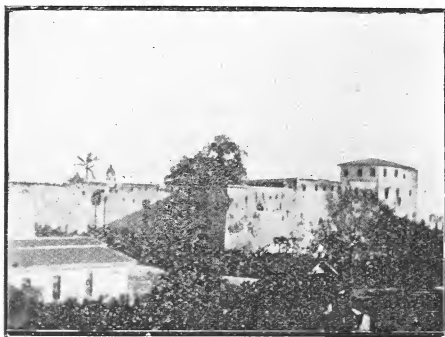


FIG. 2.—Mediæval Portuguese Fort at Mombasa.

probable eventualities connected with the Dervish occupation of the Upper Nile spreading as it did to the very borders of the Uganda Protectorate. As a matter of course the economic advantages of such a line to the Protectorate through which it passed must have strengthened the government in coming to a decision in the matter. Persistent opposition to the scheme was offered, but fortunately

the whole of the Opposition and a substantial majority of the party then in power were in favour of the scheme. Thus the accession to power in July 1895 of Lord Salisbury's government in no way interfered with the project, and at the end of that year the first rail was laid. It was not, however, till six years later that the first engine made the journey from Mombasa to the lake. The cost of the railway—£6,000,000—has been strongly criticised, and contracting engineers have asserted that they could have completed the line in half the time, and at little more than half the cost. This may or may not be the case, but experience in South Africa would seem to point to the conclusion that the railway contractor limited to time is more expeditious in his methods than the appointed government official on an annual salary; and in railway work more than in most other departments of industry the saying “Time is money” has its full significance. Though most of the country traversed by these 584 miles of rail admits of an easy gradient and rapid work, two great physical obstacles had to be faced. The Straits separating the island of Mombasa from the mainland necessitated the construction of a

bridge 1732 feet in length; also the Great Rift Valley had to be traversed. From the highest altitude—about 7400 feet—at the western face of the Kikuyu plateau the drop is 1440 ft. (of which 1000 ft. is very abrupt) in 85 miles, while the summit of the Mau escarpment, on the further confines of the valley, is nearly 100 feet higher. It is satisfactory to know that the railway has already, in spite of its great cost, justified its existence, for not only was it paying its own working expenses five years after being open to traffic, but it has been the means of attracting to its precincts those who are destined to form the basis of a considerable colonial community. With a view to giving a general impression of the country through which this railway passes in particular, and of that part of British East Africa already under control in general, I do not think I can do better than reproduce a short extract from a paper I read in January 1906 before the Royal Geographical Society.

Leaving the coast late in the afternoon of one day, daylight on the next “found us some 200 miles from Mombasa, and at an altitude of about 3000 feet above the sea-level. To the explorer, sportsman or naturalist, this journey along the Uganda Railway is of supreme interest. The physical features of the country are continually changing—savannah, scrub, and open plain are passed in turn; undulating downs and wide flats succeed one another as the train slowly climbs to Nairobi at an altitude of 5450 feet—an average gradient from the coast of 20 feet in the mile. The scenery throughout is eminently African. In spite of its varying characteristics I saw nothing new to me, merely so many samples of what I had passed through in other parts of the continent, though for the most part these are samples of the best. At one time or another one could imagine oneself on the grass downs or plains of Griqualand West or the Transvaal, in the acacia scrub of the Bechuanaland Protectorate or Unyoro, or among the brighter savannahs of Barotseland and Katanga.

“During the latter part of the journey game is never out of sight. The zebra, the hartebeest, Grant’s gazelle and Thomson’s gazelle are numerous, while waterbuck, wildebeest, ostrich, palla, and the smaller antelopes are fairly common. Before the rinderpest swept the Upper Zambezi basin in 1896, Barotseland probably equalled East Africa in quantity and was richer in variety. Since those days I have never seen anything to equal the sight which now is within reach of any one travelling to Nairobi by rail. One fact was particularly noticeable when we made the journey. The Athi plains were bereft of everything green—every blade of grass. It transpired that a few days earlier myriads of caterpillars had made their appearance in a single night, and extending for miles to right and left, these writhed themselves onwards in a living mass so dense as to obscure the very earth. So thick were they that their crushed bodies on the rails denied the flywheels of the up-country engines their grip, and the trains were continually brought to a standstill, and, in fact, were only set in motion again by a frequent application of sand to the rails. . . . The journey to Nakuru—the station in the bed of the Rift Valley . . . is remarkable for the

magnificence of the view as seen from the train during its descent from the Kikuyu escarpment into the Rift Valley. The train winds its way through a cutting in dense primæval forest. Through the clearing and from occasional open patches, a most comprehensive view is obtained of the red-brown valley 1500 feet below, and of the purple hills behind, which culminate in the blue outline of the Mau escarpment. One looks down on the summits of considerable hills, and can almost see into the crater of the extinct volcano Longonot." One of the great features of the western provinces of British East Africa is the magnificent plateau land which rises on either side of the Rift Valley to altitudes reaching to 8500 feet above sea-level. These plateaus are largely made up of open grass downs between 6500 and 7500 feet, while below 6500—and above where the ground is stony—the type of small savannah found in many parts of Africa prevails. The downs supply first-class cattle pasture, capable of supporting immense herds. The prime condition of the cattle and donkeys fed on it gives practical proof of its high quality. On the highest levels, *i.e.* between 7500 and 8500, there exist extensive belts and patches of magnificent virgin forest. Mighty trees rising to nearly 200 feet are matted together with jungle so dense as to make progress among them very slow and tedious. So dense is the matted undergrowth of ropelike creepers, giant thistles and other entanglements which dispute every step, that progress is impossible without the help of much cutting and slashing. The forest edge is so well defined that it is impossible to say whether yards or miles separate the traveller from the plains beyond. So easy is concealment from the eye of man that game is rarely seen or even heard, and yet the foot spoor bears evidence of its existence. The giant bushbuck or bongo, standing over 4 feet 6 inches at the shoulders, has never yet been so much as seen by European eyes, and would be entirely unknown were it not for the existence of something less than half-a-dozen skins and horns taken in pitfalls by natives. The case of the bongo is in fact identical with that of the okapi, known to exist under similar conditions a few hundred miles further west. A skeleton, said to be that of a giant pig standing as high as an ox, has been found in one of these forests. However, without appearing to be incredulous, I think we may wait for more definite evidence before giving him a name. Nevertheless, that many facts of undiscovered interest lurk within the sunless gloom of these great relics of centuries long since passed is not to be doubted.

Among the trees there is to be found a sprinkling of first-class timbers, and of course, as usual, a still larger proportion of wood of inferior quality. The podocarpus and juniper are well represented, but perhaps the most striking of all is a giant cedar which towers upwards in a thick straight stem. The industrialisation of these forests has already commenced, and in the future this traffic in timber should become a great commercial asset when once the railway management have accepted the principle that cheap rates to the coast not only fill trucks which would otherwise return empty, but, in offering substantial encouragement to the settler and thereby fostering enterprise, increase the up-country traffic also. From an agricultural standpoint these high

plateaus, though admirable for stock-rearing purposes, do not offer as good prospects as do the five to six thousand feet levels which are not subject to the night frosts and high winds of the invigorating uplands. Potatoes are grown with such success that already considerable consignments have been shipped to South Africa. Tree-growth is abnormally rapid, and agriculture generally should play a most important part in the development both of East Africa and Uganda. A certain amount of ivory and rubber finds its way to the coast, and experiments are being made in the cultivation of cotton, but as yet with no very definite results. The revenue is principally derived from customs, duties and game licences, and does not half cover the expenditure. The imports in 1900 stood at £193,438 as against £741,785 in 1904—a very substantial increase of £548,347. The exports in 1900 were £113,205; in 1904 they had rather more than doubled this figure. Uganda may be said to be in a stagnant condition mainly owing to the absence of cheap lines of communication. The Nile is the natural outlet to Uganda, and until—at a small cost as compared with the great interests involved—the one bar to free navigation is removed, Uganda cannot progress satisfactorily.

Twenty years ago it transpired that Great Britain was in imminent danger of becoming seriously embarrassed in South Africa. Information, said to be supported by more than circumstantial evidence, came to the notice of the Cape Government to the effect that Germany was preparing to expand her Damaraland Colony eastwards as far as the Transvaal border. This accomplished, the partition of the country northwards between Boer and Teuton would be an easy matter. Those who recollect the history of the German acquisition of Damaraland—a country at the time considered the natural hinterland of the Walfisch Bay settlement—will not marvel that such a design should have been fostered with quite a reasonable hope of success; and after all said and done we had less claim to Khama's country, contiguous as it was to the Boer Republic, than to the aforesaid hinterland. Fortunately for the material and political prospects of British South Africa there sprang to the front one of those powerful personalities which at rare intervals flutter as it were across a page of history, accomplish the purpose for which they seem to have been created, then returning whence they came, leave behind them an influence which moulds the course of history for generations yet unborn. To speculate on the course events may take in South Africa in the light of the extraordinary political situation recently created would be to play with hypothetical uncertainties, but what man not utterly devoid of the virtue of patriotism



FIG. 3.—Pemba Station on the African Transcontinental Railway, NW. Rhodesia.

can ponder with equanimity on the course destiny was following in the eighties had it not been arrested and remoulded by the strong hand and courageous policy of the late Cecil J. Rhodes.

In February 1888 the first sign of coming events showed itself in the conclusion of a treaty between Great Britain and Lobengula, which placed Matabeleland within the sphere of British influence. The Matabele Chief by this instrument undertook to refrain from entering into any correspondence or treaty with any state or power other than ourselves.

In October of the same year, Mr. Rudd, on behalf of a syndicate which included Mr. Rhodes and Mr. Beit, obtained a concession of mineral rights over the whole of Lobengula's dominions, in exchange for a monthly payment of £100 and 1000 Martini-Henry rifles.

Shortly afterwards a second expedition arrived at Bulawayo on a similar errand. It was led by Mr. E. A. Maund on behalf of "The Exploring Company, Limited," of which Mr. George Cawston and Lord Gifford were the moving spirits. Though anticipated in its designs, the latter group successfully entered into negotiations with their more fortunate competitors, which led to an agreement to co-operate on the basis of a quarter-interest. This amalgamation of interests was sufficiently powerful to command consideration both at home and in South Africa.

A year later a Royal Charter, bearing the date of October 29, 1889, was granted conferring on what now became the British South Africa Chartered Company administrative and other functions in the country concerned. The first board was presided over by the Duke of Abercorn, who has retained the position ever since, and contained, among other well-known noblemen and gentlemen, Mr. Cecil Rhodes as managing director. Under the influence of such a man an active and progressive policy was assured to the new enterprise, but the rapidity of the first steps towards the consummation of the ideal in view opened the eyes of the most sanguine. At the time the railway terminus stood at Kimberley, and that of the telegraph at Mafeking. Within six months a special force of military police had not merely been recruited, organised and equipped, but with all necessary wagon transport had marched 650 miles from Kimberley and were on duty at Macloutsie, which had been selected as a base of operations. On July 5th the first troop moved northwards as escort to the pioneer force. At Tuli River, on the borders of Mashonaland, a fort was constructed and garrisoned by one troop, and on the arrival of two further troops from the south, the force, in all 380 strong, continued its march, with the result that the British flag was hoisted with due ceremony at Fort Salisbury on September 12, 1890, i.e. inside of eleven months from the date of the granting of the Charter. In the meantime the telegraph wires were opened to Palapye (320 miles onward), and the extension of the railway to Vryburg—120 miles—was all but completed. Great were the hardships experienced by these early pioneers. Scarcely were they established in their new quarters than the wettest season within memory of man before or since broke over the country. The rivers flooded and remained

impassable for months, and thus cut off from supplies they were compelled to subsist largely on native corn, and many good men, weakened by lack of proper nutriment, succumbed to fever and dysentery. From that day to this exceptional obstacles have been met and overcome. The Matabele War in 1893 was not only costly, but acted as a brake to progress. Annual visitations of locusts followed. Early in 1896, after leaving Barotseland in a state of plenty, I emerged from the Kalahari to find a second native rising by which over two hundred white men, women and children had already lost their lives. Added to this, drought was already creating a famine, and locusts were making that famine more complete, and throughout the length and breadth of the land the rinderpest had swept off whole teams of oxen. To meet these unexpected troubles special measures were being taken, and railway construction was being pressed forward. On the top of all this the grave situation in the Transvaal continued to create such a sense of anxiety and insecurity as to impose a heavy drag on industry and enterprise throughout the sub-continent. In 1899 the South African War sent things from bad to worse.

In spite of all this Rhodesia as a colonising concern has outstripped all her compeers. From Tuli to the Congo State, and as far as the southern shores of Tanganyika, the country is effectively under control of administrations of which the remotest districts have their executive officers. There are 2148 miles of railway—more than double the sum total of the railway systems of all the other colonies discussed in this paper; and while the combined European population of these latter is roughly estimated at 3000, that of Rhodesia already exceeds 13,500. The telegraph system embraces a mileage of 3984 miles, including the transcontinental lines. The imports of Southern and North-Western Rhodesia combined amounted to £1,290,750 in the year ending 31st December 1905, and the exports from the former to £1,892,488. Thus this youngest of British African Colonies easily heads the list under the headings of communication and white population and trade, and that in the face of abnormal obstacles which there is every reason to hope have run their course and will not long continue to check progress. As regards revenue, the receipts in Southern Rhodesia from all sources in the financial year ending March 31st, 1905, amounted to £523,669, and expenditure for administrative purposes £499,768—a surplus of nearly £24,000. In the case of the two northern administrations, which are some ten years younger than Southern Rhodesia, the revenue stood at £48,030, and the expenditure at £150,177, leaving a deficit on the whole of £78,246. It is hoped that this will be reduced to vanishing point this year. Space will not allow of my going more fully into the material prospects of this most promising colonial enterprise. Suffice it to say that, mineralogically speaking, there is probably no country so rich. The gold output in Southern Rhodesia shows a steady annual increase, and up to October the figure for this year was already considerably in excess of last year's output. By the time the railway, already under construction, which is to connect Lobita Bay on the West Coast with the northern goldfields is completed, we may

expect a great development in the north in this as in many other industries. Besides gold, copper, zinc, lead, silver, coal and other minerals are being worked. One result of the railway extension opened



FIG. 4.—Settler's first Residence.

in September to the Rhodesia Broken Hill mines, 374 miles beyond the Victoria Falls, is that already a large quantity of zinc ore is being exported. More important still do I consider the prospects of planting, agriculture and cattle ranching, especially in North-West Rhodesia, for without land settlement no colony can ever fulfil its functions successfully. Minerals attract to

a country a floating and active population, most members of which go out not to settle but to return whence they came either as wealthy men or as paupers. On the land surface is established not only a settled population but the hundred-and-one industries and manufactories deriving their raw material from husbandry, as well as professions and trades supported by such a community. From the time when I was the only European in a position to discuss the then unmapped districts of Barotseland, or, as we now call it, North-West Rhodesia, I have held the country up as one of the gems of British Africa. As my experience has widened nothing has occurred to modify this opinion. In addition to most favourable land conditions, the rainfall since first gauged has shown extraordinary stability; so unlike South Africa, where droughts are frequent. Lung-sickness and "tick" fever, so decimating to cattle from the Zambezi southward, have been kept out of the country, and as there is a good stamp of native beast in the country it is to be hoped the present wise policy of prohibiting importation will be continued indefinitely.

I will now compare the administrative conditions of settlement which I noted in British East Africa last year with those I found in North-West Rhodesia this year. I have always been an advocate of an intelligently progressive colonial policy as being by far the most profitable; and here we have, it would seem, an admirable example of wisdom and error personified in those on whom has fallen the grave responsibility of guiding the destinies of two young colonies.

In East Africa and Uganda the government price of land is 2 rupees, *i.e.* 2s. 8d. per acre—about five times its value, and thus at the outset a stone is tied about the neck of the settler. The railway, a government concern, makes no special terms for him and his family on entering the country. He is tolerated but not encouraged. In North-West Rhodesia the settler pays 8d. per acre for agricultural and 3d. for cattle

grazing land. He enters as an occupying tenant for five years, paying as rent 5 per cent. per annum on the purchase price, and having proved his bona fides he obtains his title on payment of the capital sum. The administration when required will loan to him government oxen, which at the end of twelve months he may return or purchase, and will make him a loan at 5 per cent. interest towards the expense of fencing. The railway not only conveys him and his family at a 75 per cent. reduction, but gives a like rebate on all goods, furniture, implements, etc., he imports during the first twelve months. Now both these countries are of the highest intrinsic value, though East Africa has the advantage of being on the seaboard, while North-West Rhodesia is 1000 miles away. The Foreign Office took the former over sixteen years ago; Mr. Coryndon was appointed first administrator of the latter six years ago. It will be interesting to note the relative position of these colonies in 1916, to compare their revenues for that year as well as the total of the ten intermediate revenues, including sale of land at 2s. 8d. and 8d. or 3d. per acre respectively; or in other words, to compare the policy of straining revenue sources to catch the eye of the taxpayer with more liberal and far-seeing methods.

The British Central African Protectorate, formerly and more correctly known as Nyasaland, represents some 68,000 of the half-million of square miles of what may be best described as British South Central Africa, the remainder being absorbed by NE. and NW. Rhodesia. The Protectorate was proclaimed on May 14, 1891—rather more than eighteen months subsequent to the Rhodesian Charter—and is therefore the youngest of our young colonies with the single exception of Northern Nigeria, part of which was, however, as we have seen, exploited by the Royal Niger Company at an earlier date. As was the case with the eastern and western protectorates, British Central Africa spent its earliest infancy under Foreign Office auspices, and with them was taken over by the Colonial Office on April 1st of last year. A few years ago the Protectorate promised to harbour a prosperous coffee-growing community, its coffee for a time realising the highest price in the European market. Unfortunately a scanty labour supply and the appearance of the coffee bug has checked, though not extinguished, the industry. Cotton and tobacco are being grown with some success, and chillies, ground nuts, and small quantities of ivory are also exported. The railway connecting Blantyre with Chiromo is approaching completion, and a branch line from the latter place to Port Herald is open to traffic. On Lake Nyasa there are seven steamers, and on the Shire about three times that number. During the last three years the European population has increased from 450 to 600.

In 1901-2 the imports stood at £135,842 and exports at £21,739, and in 1904-5 at £220,697 and £48,463 respectively.

Of the old self-governing South African Colonies I will say but little. I was in South Africa only a few months ago and saw and heard enough to fill me with despondency. Though racial, political and economic rivalries may cause irritation and bitterness, these are temporary evils capable of self-adjustment if only allowed to run their natural course.

What hurts, irritates, and prevents such sores from healing is the knowledge that South African interests are being made the cat's-paw of political vote-catchers at home, and too often are misconstrued and discussed in a hostile spirit by politicians whose experience of the Empire may be said to be limited by the boundaries of their own parishes. Read the history of South Africa since it fell under British domination a century ago and you will marvel at the strange inconsistencies and unsettling reversals of policy emanating from Downing Street. You may even marvel what spell has retained the loyalty of a large minority. My endeavour has been—so far as time has allowed—to give a general account of our young African Colonies as well as a description of the main surface characteristics of the continent being so rapidly transformed into administrative systems from which will be evolved states destined to assist in the completion of the destruction of Europe's monopoly in progressive civilisation so forcibly commenced by the United States and Japan. The growth of these embryo states has been phenomenal from the point of view of space. Thirty years ago British Africa represented but 274,380 square miles, fifteen years back it had grown to 1,904,660, and to-day it stands at 2,536,900, or if we may include Egypt, whose destinies are equally in our hands, to a round three and a half millions of square miles, or 29 times the area of the British Isles. From the borders of the Transvaal northwards, all our colonies and protectorates are within the tropical zone, from which the manufacturer draws probably four-fifths of his raw material. Owing to the leading part our countrymen have taken in the work of original geographical work, we have been able to monopolise a preponderating share of Africa's plateau-land, on which Europeans may settle without prejudice to health. Thus quantity combines with quality.

An interesting point in this page of Empire has been the extraordinary reluctance of successive governments, as compared with foreign governments, to assume responsibility. Wellnigh every mile has been earned by private initiative, individual and collective. I fear we cannot credit this traditional governmental apathy with better intentions than the mere shirking of responsibility, but it has none the less had, on the whole, a most desirable effect, for expansion under such conditions, no matter how wide in its effect, cannot be over-expansion nor yet artificial, but is in fact a demonstration of a degree of national vigour auguring well for the destinies of the race capable of its accomplishment. Thank Heaven, Great Britain takes a much wider interest in her world-wide inheritance than was her wont ten years ago! May she rise still more to a sense of her greatness and her responsibilities! Those three and a half million miles impose a sacred duty on each one of us, and each should take his share in spreading the Imperial spirit—I use the term in no jingoistic sense—until it has permeated every class of society. Patriotism because unselfish, is one of the highest of virtues, and as such ennobles the mind and endows it with a cleaner judgment—a judgment less tarnished with mere personal considerations. With a more thoroughly Imperial-minded electorate, no government would dare to perpetrate any such act of folly as lost us our American Colonies, and the dread of possible disintegration

would no longer be felt as it unhappily is to-day. To suggest that our oversea fellow-countrymen will ever willingly expatriate themselves is to disclaim all knowledge of the sentiments dominating them as a whole. Their blood is our blood, all our glorious traditions of the past are theirs also, and with us they share the right to a common heritage. There is no reason why, by an ill-conceived policy, the work of generations of British manhood should be lost to them and us, but there will be no security against the repetition of such a folly until we admit that our great self-governing colonies are already ripe to assist in the government of the Empire they adorn.

Let those who dream of universal peace through the medium of international arbitration abandon their impractical and delusive hopes and work for a consolidated Empire, through which means alone this high object is in practice possible. To my mind universal peace is impossible until one nation not merely occupies so powerful a position as to command deference, but by its liberality and disinterested world-policy compels the respect of the universe. Break up the British Empire, and with the increase in the number of independent states there will be greater scope for avarice and a consequent increased risk of war. Foster its growth and retain it in its integrity, and the peace ideal is not unattainable.

PRINCE CHARLES FORELAND.¹

By WILLIAM S. BRUCE, F.R.S.E.

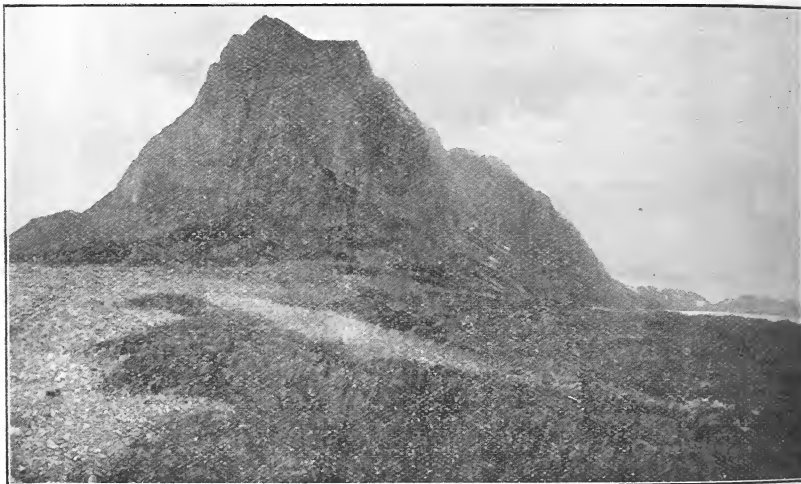
(*With Illustrations and Map.*)

ON June the 17th, 1596, Willem Barents-zoon (or Barents) and Heemskerke Hendickszoon discovered Spitsbergen after approaching it from the north-east, probably sighting in the first place the island of Cloven Cliff. Steering southward along the west coast Barents and Heemskerke sighted a steep point on June 25th, and on the 26th anchored between it and the mainland. This steep point Barents named "Vogelhoeck" because of the large number of birds there. We may therefore quite definitely state that Prince Charles Foreland was discovered on the 25th of June 1596, only eight days after the sighting of Spitsbergen.

There appears to be some doubt as to the exact time when this island was named Prince Charles Foreland, but already, in 1612, the British called it so, while the Dutch called it Kijn Island, after a Dutchman who broke his neck there that year. The name Prince Charles Foreland therefore seems to have full historical priority, the island having been named after the son of James VI. of Scotland. Hudson possibly may have given this name to the island, since he visited this part of the Spitsbergen archipelago in 1607. In 1610 the Muscovy Company dispatched Jonas Poole in the *Amitie* to Bear Island, and missing Bear Island, Poole sighted the south end of Spitsbergen on

¹ Outlook Tower and Scottish Oceanographical Lectures, February 13, 1907.

6th May. On the 21st of May Poole was off the south point of Prince Charles Foreland, which he named Black Point, and landed at Vogel Hook on the 26th of May. From this time until 1775 the Foreland was frequently sighted and doubtlessly landed upon, but still little more was known of it than in the days of Barents. In 1775 Phipps was sent out on a North Polar Expedition by George III. on the recommendation of the Royal Society of London, and it is interesting to note that Horatio Nelson was a midshipman on board the *Carcass*, one of Phipps's ships. The Foreland was sighted and a peak measured estimated to have an altitude of 4509 feet.¹ Almost every ship cruising along the west coast of Spitsbergen has sighted the Foreland, and frequent landings and



Vogel Hook from NW., discovered by Barents in 1596.

winterings have certainly been made (as I know by my sojourn there last year), but the curious fact remains that up till last year no serious attempt had ever been made to survey this large island, and thus practically all the accounts are from navigators who have only seen the island from a distance, and are therefore very far from accurate.

Scoresby's first landing in an arctic country was on Prince Charles Foreland at Vogel Hook, but on account of bad weather he was obliged to put off with haste, and had difficulty in regaining his ship. He says that "the number of birds seen in the precipices and rocks adjoining the sea was immense; and the noise they made on our approach was quite deafening."

He was also ashore several times in 1818 at Mitre Cape, a prominent point on the mainland opposite Vogel Hook, probably having connection

¹ See p. 153.

with it by a submarine ridge. He rightly describes this as being "a remarkable point, and dangerous to shipping going into King's Bay or Cross Bay, being surrounded by blind rocks."

"The middle of Charles' Island," says Scoresby, "is occupied by a mountain chain of about thirty miles in length, rising on the west side from the sea, and on the east from a small strip of table-land, only a few feet above the level of the ocean. In some parts of the coast, indeed, the table-land, from which the mountains take their rise, is even below the level of the high-water mark, and is only prevented from being covered by a natural sea-bank of shingle, thrown up in many places to the height of ten or fifteen feet."

Scoresby gives further descriptions of Prince Charles Foreland, emphasising particularly the strange hill named the "Devil's Thumb"; but his description saying that "the highest mountains take their rise at the water's edge," is scarcely correct, for a series of raised beaches intervene between them and the sea. But this further description is good, where he says, "The points formed by two or three of them are so fine, that the imagination is at a loss to conceive of a place, on which an adventurer, attempting the hazardous exploit of climbing one of the summits, might rest. Were such an undertaking practicable, it is evident it could not be effected without imminent danger. Besides extraordinary courage and strength requisite in the adventurer, such an attempt would need the utmost powers of exertion, as well as the most irresistible perseverance." But probably easier ascents, by way of the great eastern glaciers, could be made than by the precipitous western crags.¹

One of the best general descriptions of the island is Lamont's,² where he says, "Prince Charles Foreland is a long narrow island separated from the mainland by a shallow sound. Although Spitsbergen is eminently a mountainous country it is more properly regarded from a geological point of view as an elevated plateau, whose sides have been broken and cut through by glacier action, to form isolated ridges and pinnacles. It has no great mountain range or backbone. In Prince Charles Foreland we find the nearest approach to such a regular arrangement of hills. And it constitutes a sufficiently striking mountain-range occupying nearly the whole sixty miles' length of the island. On the west side the rise from the sea is abrupt and precipitous, but on the east the descent is more gradual to low ground a few feet above the level of the sea. On the latter side the glaciers have considerably encroached. The chain of mountains is broken towards the southern extremity, and gives place to a low, sandy flat, where numbers of sea-birds congregate in summer. With the telescope we could make out the wreck of a timber-vessel, which came from the Petchora river five years ago, had been abandoned at sea by the crew, and was cast up on this shore. About the middle of the island a singular black rock—or rather mountain, for it is 2000 feet high—jutting out into the sea has been termed the 'Devil's Thumb.'

¹ *An Account of the Arctic Regions.* By W. Scoresby, Jun., F.R.S.E., pp. 97, 98; and 118, 119. Edinburgh, 1820.

² *Yachting in Arctic Seas*, by James Lamont. 1876. Section III., pp. 229, 230.

Some of these mountains rear their needle-like shafts to an elevation of from 3000 to 4000 feet."

Baron Nordenskjöld explored Foreland Sound in a boat in 1868, and sailed through it with his ship in 1872; while Lamont navigated it with his yacht the *Diana* in 1869; Conway in 1898 and the Prince of Monaco in 1899 also ran through with steam launches.

Dr. A. G. Nathorst was the first in 1898 to attempt anything like a systematic investigation of the island, but these observations were only over a period of two or three hours during a summer night when he sent a small party ashore from his ship the *Antarctic*.¹ Nevertheless he was able to give us a more concrete idea of this unknown land than any of his predecessors. Here is his description of the discoveries of his party² :—

"24th July 1898.—In the afternoon we were sounding to the south-west of Prince Charles Foreland where the depth was 240 metres, and afterwards I headed for this land to effect a landing. The south part of the Foreland greatly resembles the north point of Duck Island (Andö, Tromsö). Here there is an isolated set of mountains, and after that a low plain, whilst to the north of this begins a veritable land of mountains. This is indeed a fine range of peaks with glaciers between them. We headed for a bay situated between two peaks called 'Sommet Fourelin' and 'Sommet Rond' by the French Expedition in *La Manche* in 1892. I think it is appropriate to call this bay after that vessel. At 11.30 P.M. our ship was headed into the harbour and one of the large boats was sent ashore with Haslam aft and four oars, together with G. Anderson, Hesselman, and J. G. Anderson. Of course no extended exploration could be made as the whole landing lasted only a couple of hours, but from a geological point of view I thought it was desirable to get to know if the Hecla-Hook formation was on the west coast of the Foreland too. I remained on the bridge until the party had landed at one o'clock on the morning of the 25th, and then I went to bed. At 3.30 A.M. I was awakened by the captain saying that the landing party had returned. The geological observations were in accordance with what we had expected, and the botanists had made a rich collection, which we had not expected. Up to this time the Foreland has been said to have very little vegetation, two phanerogams only having been known on the island. It was therefore surprising that G. Anderson and Hesselman in these three hours had found no fewer than twenty-nine species. Of birds, the eiders were common and the lumnefaglar were very numerous.

"Then we headed for the west and took a sounding at noon of 1474 fathoms about 28 miles outside the Foreland."

Garwood, who visited Spitsbergen with Gregory on Conway's Expedition, writing to me on June 18, 1906, says, as far as he remembers, "Prince Charles Foreland is composed of Hecla-Hoek beds. Those

¹ Formerly called *Cup Nor*, and renamed *Antarctic*, 1893, by Svend Foyn previous to her first Antarctic cruise 1894-1895; afterwards Dr. Otto Nordenskjöld's ill-fated ship during his memorable Antarctic Expedition 1901-1903.

² Translation from *Tva Somrar Norra Ischafvet*, etc., by A. G. Nathorst. Stockholm, 1900. Vol. i. pp. 187-188.

horribly uncompromising slates, quartz bands, and schists in which I was never able to get anything definite, though I have found curious oolitic beds from these rocks in Hornsund Bay. I know that the rocks of the main island opposite are Hecla-Hoek, and although I never landed on Prince Charles Foreland (except when we touched bottom in our launch), I have notes that the rocks coming down to the water on the east side are almost certainly Hecla-Hoek beds. I only state this for what it is worth."

Last summer His Serene Highness the Prince of Monaco invited me to accompany him now for the third time on a voyage to Spitsbergen. I gladly accepted His Highness's invitation, but pointed out that I would like to be associated with some definite work, and suggested, among other alternatives, that he should land me with two assistants on Prince Charles Foreland in order to make a thorough investigation of that practically unknown island. The Prince at once accepted my suggestion, and having chosen two assistants I set about making preparations, in the first place for a systematic geodetic survey of a definite portion of the island, and secondly for acquiring a more exact knowledge about its geology and natural history. My assistants were Mr. Gilbert Kerr, lately piper and taxidermist to the *Scotia*, and Mr. Ernest A. Miller, a young electrical engineer. On 27th of June the *Princesse Alice* steamed into Granton, and on the 28th took her departure with the Scottish party on board.

After a somewhat cold, bleak, and choppy passage—typical of the North Sea—the *Princesse Alice* reached Bergen on 30th of June. Here the Prince took on board another exploring party, Norwegians, headed by Captain Isachsen of the Norwegian cavalry, who had previously seen arctic service with Captain Sverdrup; and Lieutenant Staxerud, a young Norwegian infantry officer, employed in the geodetic service of the Geographical Society of Christiania. In all the Norwegian party consisted of ten men, who were to take up the exploration of the north-western corner of Spitsbergen, lying between Close Cove,¹ Smerenburg Sound, Red and Liefde Bays. Tromsø was reached on the 9th of July, and at 1.30 P.M. on 11th July the south end of Prince Charles Foreland was sighted. From our noon position we steered for the north end of the Foreland, Vogel Hook (or Fair Foreland), and between six and seven in the evening were running fairly close to the shore north of Cape Sietoe. At 7.15 P.M. we were off the north-west point of the Foreland, which bore S. 40° W. about two miles, and on sounding obtained ten fathoms, having had eight fathoms just previously closer to the land. About 8.30 P.M. we were off Quade Hook, and finally, after some difficulty on account of the rapidly shelving bottom, anchored in Coal Haven, King's Bay, about 11.30 P.M. Just after anchoring there were several white whales near the ship, and the Prince lowered a whale boat with Wedderburn in charge to try to secure one. Next day Isachsen and his party left by the *Kvedfjord* (a small steamer chartered by His Highness) for Close Cove, while

¹ Close Cove, so named by Pool, 1610, and Ebeltoft's Harbour, named by him Cross Road. British Admiralty Chart and other modern charts call Close Cove, Cross Bay. Vide *No Man's Land*, by Sir Martin Conway. Cambridge University Press, 1906.

Captain Carr, Professor Hergesell, and I went ashore to make observations with the theodolite for the ascent of a pilot balloon which had been liberated from the ship.¹ Afterwards I made a short excursion towards a rather remarkable waterfall, which fell over the edge of a glacier ice-cliff about two miles from the shore; and it is interesting to note that although a very large volume of water was coming over the ice at this time, that at about midnight, when I was in the crow's-nest and could get a good view of the same place from that elevated position, no water at all was coming over the cliff. The small river from this source, that ran into Coal Haven, was also practically dry. Some doubt may exist as to the cause of this sudden stoppage of the flow of water, but it may be sufficiently accounted for by a touch of frost, which had stopped the surface thawing of the glacier caused by the brilliant sun during the day. On July 14th the *Princesse Alice* left King's Bay for Close Cove, and at about 1 P.M. the Scottish party left on board the *Kvedfjord* for Prince Charles Foreland.

The Foreland being practically unknown, it was with some difficulty, especially in view of the soundings obtained, that we found a suitable landing-place. A suitable place was, however, eventually found on the east coast about three miles from the north end of the island. By about 2 A.M. we had succeeded in landing all our equipment from the *Kvedfjord*, and she steamed back to the *Princesse Alice* in Close Cove, leaving Kerr, Miller, and myself to set up camp. Next day was spent mostly in arranging our stores and in making plans for excursions for the purpose of surveying the island. One excursion was made that evening northward along the shore for a distance of about two miles, and a start was made at the survey. On the next two days other excursions were made westward, and we reached the highest point between the two sides of the island, in a narrow gorge, which we called "Windy Gowl," on account of its resemblance as a wind funnel to the place of the same name in the neighbourhood of Edinburgh. On the 17th we set to work more seriously, and shifted camp from the east coast to the neighbourhood of Windy Gowl. We carried no tent, because the extraordinarily rough nature of the ground prevented us taking more than our instruments, a few provisions, and sleeping sacks. The country over which we passed was almost absolutely barren, there being hardly a plant along the whole route, and only two birds were seen, namely, one purple sandpiper and one Arctic skua. On settling down for the night we had three other visitors, namely, two skuas and one fulmar petrel.

The journey was a somewhat laborious one, the distance of three or four miles having taken us over seven hours. The weather was brilliantly fine and the sun scorchingly hot, so that we divested ourselves of as much clothing as possible, and even then sweated it out. There was bright sun all night, with a cloudless sky and a light westerly air. The scene from Windy Gowl was a striking one. To the eastward we looked back over the dreary stony plains we had crossed, and beyond

¹ Vide H.S.H. the Prince of Monaco's lecture on "Meteorological Researches in the High Atmosphere," Edinburgh, 17th January 1907, printed in the present issue, p. 113.

the Foreland Sound over the picturesque glacier-clad mainland of Spitsbergen in the neighbourhood of King's Bay. To the westward, beyond a less extensive but more fertile plain broken by several lagoons along the shore, stretched the calm western ocean, with no land between us and Greenland, and I may say at this time with no ice in sight. On 18th July I sent Kerr and Miller back to the base camp for more stores, while I descended to the west coast and explored northward for some distance, making many preliminary observations and securing a fox and a pink-footed gosling. The west coast was evidently very much more inhabited than the east, for I came across several gaggles of pink-footed geese, as well as eiders, purple sandpipers, and snow buntings. I got back to camp about 11 P.M. in cold and misty weather, and Windy Gowl keeping up its reputation, compelled us to shift camp about midnight and go down to the plain below. Even there, sheltered as we were, we found the night cold enough without a tent.

Having taken longitude observations at this third camp on 20th July at about 9 A.M., we started back again unloaded at 10 A.M. for the base camp, doing the homeward journey, which had taken us seven hours when loaded, in about two hours. With all possible haste we launched our boat, carrying with us a tent, and loading her well up with sufficient provisions for a week. Then putting out to sea, we steered northward in order to reach the west coast of the island in the vicinity of the camp we had left in the morning. At Vogel Hook we were compelled to run for shelter into a cove, on account of a heavy sea and wind which got up from the westward. We were ashore for about two hours, investigating the wonderful bird rookeries, first discovered by Barents in 1596.

The vegetation was luxuriant with rich mosses, scurvy grass, and many Arctic plants. Birds were countless—Bruennich's guillemots, puffins, little auks, dovekeis, kittiwake gulls, burgomaster gulls, skuas, fulmar petrels, pink-footed geese, purple sandpipers, and snow buntings. The sea and wind subsiding somewhat, we continued our course round Vogel Hook to the westward, and with some difficulty effected a landing about one mile south of Vogel Hook on the west coast, as there was too much sea for us to continue our voyage southward. It became necessary therefore to push southward overland, that we might reach the camp gear which we had left in the morning and bring it back to this new camp further to the north. It was fortunate that we had our tent this night, for it began to rain, a rain which was to continue almost without halting for the next fortnight.

The camp was a most picturesque one, lying near the rugged, rock-bound, reefy shore, on which the wild western sea broke furiously, threatening our boats and gear, which we had to haul well up on shore that they might not be carried away. Rising at the back of us was a short and sharp talus, surmounted by a precipitous cliff of hard old sandstone, probably belonging to the Hekla Hook series. The innumerable birds in these cliffs gave us a continual concert with their myriad voices, while the barking of foxes, curious at our intrusion, resounded from the caverned taluses of massive fallen rocks; every now and then one more curious than the rest would approach us, though with the greatest

caution. We discovered two lairs of foxes in the talus, and attempted to dig them out, following their position by their continuous growling and barking. It was soon obvious, however, that this attempt was absolutely futile, for the lairs communicated with one another by endless galleries between the interstices of the large loose rocks.

We had now been ashore for a week, and even in this short time had recorded more definite information of Prince Charles Foreland than we



Scottish party's camp on west coast one mile south of Vogel Hook.

had been able to gather together from the books and records of more than three centuries. We had made a survey in the neighbourhood of Vogel Hook; we had some more exact idea of the nature of the rocks; we knew definitely many of the mammals and birds that inhabited the island; and had collected up to this time twenty-four species of flowering plants.

We remained at this camp until the 1st of August, during which time the weather was continuously bad. Gale followed gale and heavy seas broke on the reefy shore, blowing the spray right over the lower land. Fog and mist prevailed almost continuously, and heavy rain was

the order of the day. Occasionally for an hour there might be a blink of sunshine, only to be followed again by thick, wet, stormy weather. An idea of the stormy weather may be had from the fact that we were never able during this fortnight even to think of launching the boat. On the 31st of July, however, we actually had a chance of attempting it, but after trying twice found it impossible owing to the heavy seas. If it was at all possible, we were due at the base camp that night, as the Prince had arranged to call there on the 1st of August to see how we were getting on. We were preparing to walk across when the weather got worse and we had to abandon all thought even of this landward march. Although we were able to do little in the way of survey, we made a number of local excursions and got to know intimately the whole of the north end of the Foreland. We collected plants and, cramped up in our tent, pressed quite a number.¹ We also made a complete collection of the rocks² of the neighbourhood, and searched long but vainly for fossils, thus confirming the records of Nathorst and Garwood as to the sterility of these beds. Several foxes were shot, for they became more daring day by day as their young grew more mature and able to look after themselves. Altogether we saw fully a hundred foxes in the course of this fortnight.

There are two kinds of foxes in Prince Charles Foreland as in the rest of Spitsbergen, where there may also be a third. The two on the Foreland are probably dimorphic forms of the same species. One is a bluish-grey colour all over, while the other appears to be what is known in Russia as the Cross Fox. On its under parts it is white, but down the back from the tip of the nose to the end of the tail runs a broad pale brownish band, which is crossed by two similar bands in the limb regions. From the many adults and young that we saw it would appear at least to be the rule that the uniformly dark-coloured fox breeds more or less separately from the lighter cross form. We have at least no record of having seen mixed parents or litters. This may even point to their being separate varieties. Towards the end of August several very light cross foxes were seen, and one was shot.

Foxes were the only mammals we had seen on the island till now, but we met with the bones of reindeer and bears, and saw an occasional seal in the water, but later on I saw two reindeer. Birds were, as I have said, plentiful, and we had many opportunities in this veritable Bird-land of recording the species to be found and of watching their habits. On the 25th of July the young guillemots, who were for the most part already hatched when we arrived, began to take to the water, and by midnight several hundreds, perhaps thousands, were swimming about with their parents who came down with them. Those which dropped on the land were at once seized by burgomaster gulls or foxes, both of which lay constantly in wait for a dainty meal of young loom. The burgies also attacked the young loom in the water, but here the parents made a vigorous defence and drove them off. Kittiwake and burgomaster gulls,

¹ The plants are being examined and described by Mr. R. N. Rudmose Brown, B.Sc.

² The rocks and fossils are being examined and described by Mr. Campbell.

black guillemots, little auks, razorbills and puffins were all breeding on these cliffs at Vogel Hook and for two miles southward along the west coast of the island. Eider ducks and pink-footed geese, both adults and young, were very numerous along the shores, but curiously enough we never found the nests or eggs of either, except on one occasion when we came upon a single deserted duck's egg. Arctic skuas bred on the plains, where we found their nests, and snow buntings' nests with eggs or young were frequently found in crannies. We found the young, but not the egg, of the purple sandpiper.¹

There are many graves on this and other parts of the island; the remains of boiling stations and huts; abandoned boats and wreckage—all relics of the former great whaling industry, when Dutch, French, and British settlers lived and died on this island as on many parts of the mainland of Spitsbergen. Most of these graves have been burrowed out by foxes, and the skeletons lie exposed in rude lidless coffins, weathered and worn. Here and there is a board or a solitary cross, whose inscription indicates the name and nationality of the dead and the time at which he lived on the Foreland. I have in some cases read dates back to the beginning of the seventeenth century, and this well accords with what we know of the activity of the whaling industry in these parts three hundred years ago.

Like many other Arctic lands there is an abundance of driftwood, especially on the west coast, and one notable feature is that a very large proportion is from the wreckage of wooden boats, possibly mostly wrecked walrus sloops. This, with the invaluable though scattered supply of birch bark, is excellent fuel, and was always used by us whenever possible.

On the 1st August, leaving our camp as it stood and only securing it against weather and the ravages of foxes, we marched over to the base camp, and in the afternoon, as neither the *Princesse Alice* nor the *Kvedfjord* had arrived, walked three miles to the southward, where we discovered eight Dutch graves. We also saw two great northern divers—a new record for Spitsbergen. At 9.30 P.M. we sighted the two ships, curiously miraged, and they anchored fully two miles from the land in $5\frac{1}{2}$ fathoms at 11.30 P.M. Next day the weather was very fine, and at 7 A.M. we were awakened by Wedderburn's welcome Scottish voice outside the tent. He had come ashore with letters and parcels. We were on board about 9 A.M. The Prince was at the gangway to meet us and gave us a hearty greeting. He had visited Wiide Bay and Danes Gat and had met Isachsen's party and Wellman's Expedition. We enjoyed the luxury of a hot bath, and then, after having gathered some necessaries, such as ropes, canvas, etc., we lunched on board at 11 and left for the shore soon after noon. The Prince took his departure at 1 o'clock to the NW. to make a balloon ascent. This was the last we saw of the ships until the 26th of August. In the afternoon I got good sights for longitude, having compared my chronometers with those

¹ *Proc. Roy. Phys. Soc.*, "The Mammals and Birds of Prince Charles Foreland," by Wm. S. Bruce, F.R.S.E., read November 26, 1906.

on board the yacht. The rest of the time was spent in continuing the geodetic work, first of all round the north end of the island joining our eastern with our western survey. We extended the eastern survey to a point about 8 miles southward from the Vogel Hook and the western to a distance southward of over 20 miles. In all we mapped in great detail an area of about 120 square miles, that being, roughly, the northernmost third of the island.¹

The topographical features of Prince Charles Foreland are striking, and as there is no accurate description given in any publication, it may be well to give a general account of these features as far as we know them at the present date.

The British Admiralty Chart of Spitsbergen, No. 2751, published in 1865 under the superintendence of the late Captain G. H. Richards, with corrections up to 1901, gives our present-day standard map of Prince Charles Foreland. This map is far from correct, and in many ways much less accurate than some of the older maps. Edge's map of Spitsbergen, published in 1625, reveals details which I know to exist and which have been obliterated in the British Admiralty chart. Edge's map has been recently emphasised by Sir Martin Conway.²

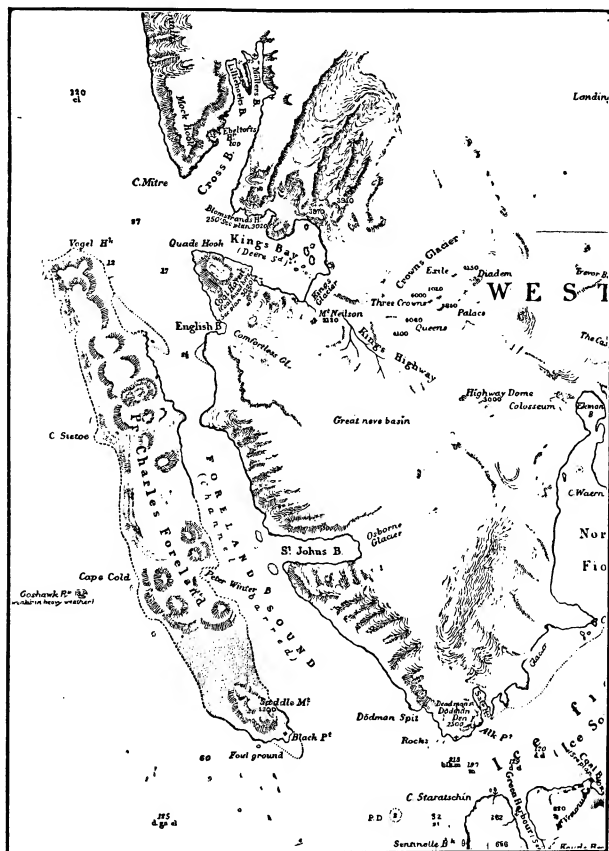
Prince Charles Foreland is a long island lying off the west coast of Spitsbergen between King's Bay and Ice Fjord; it is separated from the mainland by a channel known as Foreland Sound, of which we know very little. This channel is, however, certainly so shallow that in parts it may, as has been supposed, present a complete bar to all vessels from 10 or 12 feet of draught. But this is not altogether so certain as has been believed up to the present day, for the series of rough soundings which I took on board the *Kvedfjord* indicate that we may have 3 or 4 fathoms of water as the least depth of the navigable channel. The water appears on the whole to deepen towards the east coast of the Foreland, but it is dangerous to make many statements, for as yet the channel is entirely unsurveyed. The Prince of Monaco's work in Close Cove and between Close Cove and Vogel Hook, and some soundings I have taken, throw preliminary light on the conformation of sea bottom at the northern end of the Sound.

Making the usual approach to the island from the southward, or probably from a little to the west of south, one's first impression is that there are two islands, and one has to be very close to the coast before one can see that there is actually continuous land where at first sight a channel appears to exist. The Foreland stretches from about 78° 10' N. to almost 79° N., and lies roughly between the longitudes of 10° and 13° E. It is divided into three regions, the small hilly portion occupying 6 or 8 miles of its southern extremity, and the extensive flat-lying portion, probably nowhere more than 20 feet above the sea, occupying roughly the next 8 or 10 miles of its length, while the remaining three-quarters of the island consist of an almost continuous

¹ This map is in the course of construction, and will be published later. Meantime a reproduction of the latest British Admiralty chart is given.

² *No Man's Land*. Sir Martin Conway. Cambridge University Press. Pp. 334-335.

range of mountains, extending right up to Vogel Hook—the northern point of the Foreland. This range of mountains, it is interesting to note, contains some of the highest peaks of the Spitsbergen archi-



Prince Charles Foreland and part of West Spitsbergen.
(From the Admiralty Chart, 1901.)

pelago. In all the Foreland measures about 50 to 55 miles in length, and has an average breadth of about 6 miles. The mountains forming its backbone rise almost always precipitously, and the ridge is only broken here and there by a rough pass from east to west. They do not, however, as a rule rise straight up from the sea, as they have been



Northernmost glacier.

Mount Monaco (8850 feet).

West coast view of highest mountains of Prince Charles Foreland.

Cape Cold.

said to do. There is almost invariably along the whole of the west coast a low-lying terraced plain (old raised beaches), the highest terraces of which do not reach a height of more than 50 or 60 feet, and this plain is for the most part half a mile to two miles broad. At the back of the plain rise the mountains with steep taluses and precipitous cliffs. In the middle portion of the Foreland, towards the southern extremity of the mountain range which we are at present dealing with, a number of glaciers find an exit, but none of them reach the sea as they appear to do, to any one sailing along the coast, but terminate on the landward side of these raised beaches. There are no glaciers at all in the northern part of the island. The east coast presents the same features as the west coast with regard to raised beaches, but they are more extensive, the foot of the mountains being sometimes three miles from the sea. The slopes of the mountains also are less precipitous on the eastern than on the western side of the land. The middle third of the Foreland along the east coast is most fully glaciated, and for about 12 miles there is an almost continuous ice-face entering the sea. These great glaciers have their gathering ground amongst the highest of the mountains that exist in the island. The altitude of the highest hill has been estimated by various people, but from exact observations made on the island I was able to measure its height as being 3850 feet.

These terraced raised beaches, which form such a marked characteristic, are dotted over with innumerable shallow fresh-water lakes, and brackish or sea-water lagoons which stretch along the shore. Some of the lagoons are very large, and there is one notable one which appears on Edge's chart, which has been wiped out by more modern cartographers. This lagoon lies on the east coast at the head of a bay opposite English Bay, and is obliterated on all recent maps. It has an excellent entrance from the sea through which a boat, of considerable draught, can enter at high tide. The breadth of this lagoon is fully a mile, while its length is from 3 to 4 miles, and inside the water is of considerable depth. It appeared to me an interesting place for the naturalist: for here, with a good supply of fresh sea-water, protected from the violence of the waves and the rending of driving ice, many forms of animal life find a quiet home. These lagoons, and some of the fresh-water lakes also, are the resort of pink-footed and brent geese, of eider ducks, and innumerable red-throated divers. Purple sandpipers dart along their shores, and occasionally a rarer bird, as for instance the sanderling and its young, which we discovered breeding here, and which is a new record for Spitsbergen. Kittiwake and burgomaster gulls also, especially after the breeding season, make their resting place here, while arctic terns are to be found flitting across, and nesting in the neighbourhood of, almost every lagoon.

The plains are, moreover, crossed at right angles by a number of burns and rivers which are fed from the snows and glaciers of the higher land. The amount of water present varies considerably in accordance with the time of year. In the early summer there is a very full supply; but as the store of snow becomes diminished later on, and as

frost binds the land the water which flows from this snow, *névé*, or even glacier also diminishes, and in autumn it may be difficult to find a suitable camping-place, through lack of even a small spring to furnish necessary water.

There is a marked difference in the vegetation of the east and of the west, the west being very much more luxuriant than the east, which is often absolutely barren for miles. More of the big bird rookeries also are to be found on the west coast, and in their neighbourhood the soil is always considerably fertilised, and vegetation consequently more abundant. Mosses, scurvy grass, tall sulphur buttercups, many saxifrages, small rosaceous plants and the arctic willow carpet and beautify the land. But even on the west coast there are sterile parts, and one not unfrequently passes abruptly from the flowery region into a veritable desert. A sign of luxuriant vegetation in the past in certain places is shown by considerable deposits of peat, which we used for fuel.

Nathorst was probably correct in referring to the rocks at the place he visited south of Cape Cold as silurian rocks of the Hecla Hook series, but, like all others, even this eminent geologist was unable to find any fossiliferous remains. Garwood was probably only partially correct, for, as far as I have been able to judge, the rocks of the Hecla Hook series form the east coast of Prince Charles Foreland except towards the northern portion. I am further inclined to this opinion by the fact that at our base camp I was fortunate enough to discover remains of fossil plants. Many of these are indeterminable, but I obtained good examples of dicotyledonous leaves and, probably, stems: and also what Dr. Peach on rough examination considers may be worm-casts. Mr. Campbell, of the Geological Department of the University, has been good enough to undertake to work through the material and report upon it. Moreover, our chairman Prof. Gregory, one of our few geologists who has actually visited Spitsbergen and seen the land over which the Scottish party worked last year, promises to inspect the collections, and will doubtless be able to help in making a good report of the geology of the Foreland. Roughly speaking, however, I think I may safely predict that the beds on the northern part of the east coast of the Foreland are tertiary rather than silurian, and are of the same series as exist in King's Bay. Half-way between Vogel Hook and Cape Siteo are very coarse conglomerates, which are probably archæan and allied to those I have previously met with in Red Bay.

During our stay on the island we made continuous meteorological observations by means of recording instruments, checked by eye observations, at as frequent intervals as other work would allow. We also made a number of astronomical observations at the eight camps which formed the centres of our work in the northern third of the island. These observations have been revised, and I have to thank Mr. Thomas Heath, of the Royal Observatory, Blackford Hill, for working up and classifying the results.

On the 30th August we finally left the Foreland, but with difficulty, on account of four days' very stormy weather, which made it impossible for boats to approach the shore. Even on the 30th we had great



Prince Charles Foreland—10 miles of east coast, from Vogel Hook southward.

Vogel Hook.



Vogel Hook.

Prince Charles Foreland—about 30 miles of west coast from Vogel Hook to Cape Cold.

Cape Cold.

difficulty, having to run the boats through surf, greatly endangering the re-shipping of our scientific instruments and other gear. On the night of the 30th we anchored in a sheltered bay with the *Kredfjord* off the large lagoon previously referred to, and during the strong gale and snowstorm recovered one of our boats which we had left in the lagoon a week previously. At 8.30 A.M. on the 31st we heaved up anchor and steamed southward towards Ice Fjord, and, sounding frequently, I obtained as our least depth 4 fathoms: but mostly the soundings were over 10 fathoms. We looked into Safe Harbour, and not finding the yacht there, steamed across to Green Harbour, coming alongside *Princesse Alice* at 4.30 P.M. Fortunately the morning cleared up, and I took some photographs and sketches of the east coast of the Foreland, identifying several peaks I had seen from the northward. I found that several of the peaks seen from the Scottish standard at the south end of the "Base Line" were the furthest south on the island. Consequently, with angles taken at some future time from another suitable point, the position of these peaks will ultimately be very well fixed. On September 2nd we heaved up anchor and steamed across to Safe Harbour, in spite of very dull weather and a fresh north-westerly breeze. On approaching the bay so much ice from the glaciers was streaming out of it, that the Prince was compelled to abandon his intention of going in, and heading out of Ice Fjord steamed towards Tromsø. At noon on 3rd September we were 30 miles west of Bear Island, sailing with the fresh north-westerly breeze. Dr. Richard found the temperature of the water much cooler in the vicinity of the Bear Island than either to the north or south of it. During the evening the foreyard carried away, but so coolly and systematically was this accident taken in hand that none of us aft knew anything about it until on going up we found the men stowing away and lashing up the yard on deck. On the 4th we sighted the northern coast of Norway, and in sight of the land the Prince made a meteorological balloon ascent to the height of about 15,000 feet. We anchored at Karlsö half an hour after midnight on September 5th. In the morning we took in the trammel net, which had been set after our arrival at Karlsö, and got a good haul of fish, and also a number of other interesting zoological specimens. We reached Tromsø at about 2 P.M., and spent most of the afternoon going over our letters which were awaiting us there. At 6 P.M. Captain Bourée took a photograph of all those who had specially helped in the exploration work, and afterwards the Prince entertained Isachsen's and my men in the cabin, toasting us all, and thanking us for the work we had done. He also told us he would have a special medal struck to commemorate the accomplishment of the scientific work that had been carried through on his yacht during the cruise.

Our party on board the yacht, which included representatives from no less than seven nations—a Babel of tongues—was, however, destined to have a gloom cast over it next morning, when Captain Henry Carr, R.N.R., who had sailed for long years with His Highness as shipmaster, was found lying on the floor of his cabin unconscious and paralysed. Fortunately both the Prince himself and Captain Bourée were ex-

perienced navigators, and there was no difficulty in carrying on properly the conduct of the ship.

On the 10th September we put in at Trondjhem, and next day the *Princesse Alice* left for Havre, instead of for Leith as was at first intended, on account of the illness of Captain Carr. Thus terminated the happy connection of the Scottish party with the *Princesse Alice*, Kerr, Miller, and myself returning to Scotland by way of Bergen, Newcastle and Leith.

This is the sum and substance of the Scottish exploration of Prince Charles Foreland, and the summary of our knowledge with regard to it up to the present day. It will be seen that much work still remains to be done, and it is not unlikely that an opportunity may be afforded me, with a larger party, including scientific men, of completing the survey of Prince Charles Foreland under the auspices of that spirited international scientist, His Serene Highness, Albert, Prince of Monaco.

PROCEEDINGS OF THE ROYAL SCOTTISH GEOGRAPHICAL SOCIETY.

MEETING OF COUNCIL.

AT a Meeting of Council, held on Monday, January 28th, The Hon. Lord Guthrie was elected a Vice-President of the Society. The following ladies and gentlemen were elected Members of the Society:—

Hume Brodie.	George Watson.	Sir Wm. Willcocks, K.C.M.G.
Mrs. K. L. Beilby.	Miss Elizabeth Rodger.	Miss M. H. L. Clark.
James S. Davidson.	John M'Lean, M.A.	Mrs. Pringle of Whytbank.
Dr. William Paterson.	Robert T. Morrison.	Miss Elizabeth R. Barty, M.A.
Alexander Hutcheson, M.A.	James Wilson.	Miss Margaret P. D. Stewart.
A. T. Graham.	Rev. W. A. Heard, M.A., LL.D.	Belpin Behari Ghosal, M.A.
Robert Campbell, M.A., B.Sc.	Mrs. Lou Henry Hoover.	Stuart Foulis.
Miss Esther Hope Day.	James Mathieson.	Fred. J. Pack.

The following ladies and gentlemen were elected "Teacher Associate" Members of the Society:—

Mrs. A. C. Buchanan.	Walter Burt, M.A.	George Elder.
Miss Ethel M. Lett.	Hugh J. C. Kinghorn, M.A.	Horace F. M. Munro, M.A.
Miss Isabella Goodlet.	Neil Fraser, M.A.	Miss Hannah Watson.
H. J. Findlay.	Miss Annie A. Dow.	Miss C. J. B. Birrell.
J. B. Innes, M.A., F.E.I.S.	John Miller Nisbet, M.A., B.Sc.	Frederick Mort, M.A., B.Sc., F.G.S.
Duncan Brown, C.M.	James Graham, M.A.	Miss E. P. Taylor.
Thomas W. Paterson.	John Ambrose, M.A.	John Frew, M.A., B.Sc.
John Grant.	Donald Maclean, M.A.	J. Corrie.
Alexander C. S. Scrimgeour, M.A.	Miss Christina A. Cameron, M.A.	Miss Margaret Johnston, A.L.C.M.
Alexander Sutherland.		
Miss Margaret F. Anderson.		

LECTURES IN MARCH.

At Dundee, on the 5th March, Mr. T. G. Longstaff, M.D., F.R.G.S., will deliver a lecture entitled "Tours in Central Himalayas and Tibet."

On the following dates, 6th, 7th, and 8th of March, Mr. Longstaff will repeat his address before the Aberdeen, Edinburgh, and Glasgow Centres.

On Tuesday 21st March, in Edinburgh, Mr. H. M. Cadell, B.Sc., will give a lecture entitled "Mountaineering in Mexico."

Sir Harry H. Johnston, G.C.M.G., K.C.B., will address the Glasgow and Dundee Centres on 20th and 21st March respectively. The subject of his address will be "Liberia."

Owing to Mr. Rudmose Brown's appointment as leader of an Expedition to the Oyster Pearl Fisheries off the coast of Burma, his lecture in Aberdeen on 20th March is postponed indefinitely.

GEOGRAPHICAL NOTES.

Professor Sir William Ramsay, D.C.L., LL.D., Litt.D.—Our frontispiece this month represents Professor Sir William Ramsay, of Aberdeen University, who was presented with the Society's Silver Medal on the occasion of his address to the Society in Edinburgh on January 31. Sir William Ramsay lectured on "Roads and Railways on the Plateau of Asia Minor," the region with which his name is so honourably associated.

The frontispiece (the Prince of Monaco) of our last issue was from a photograph by Lafayette.

EUROPE.

The Flora of an Island.—In connection with the papers which we have published here from time to time on the distribution of plants in Scotland, it is interesting to notice a recent communication to the *Transactions of the Edinburgh Field Naturalists' and Microscopical Society* (Session 1905-6) by Miss Beatrice Sprague. The paper gives an account of the flora of an island of shingle in the river Orchy, Dalmally, Argyll. The island is of recent formation, and consists of beds of coarse shingle, and of an area where the shingle is covered with river sand. While the former part is almost bare of vegetation, the latter is thickly clothed. Vegetation apparently began to grow here about twenty years prior to the writing of the paper, but did not become noticeable until about five or six years ago. In spite of the poor soil and liability to flooding, no less than 143 species of plants were obtained upon the island, of which 137 were flowering plants. A careful study of the sources of the flora showed that the vast majority of the plants come from the immediate neighbourhood, nine were mountain plants apparently brought down by streams, and nine were garden escapes. As is natural under the circumstances, an analysis of the plants emphasises the importance of water rather than of wind carriage.

The Survey of Lake Balaton.—We have received copies of the *Resultate der Wissenschaftlichen Erforschung des Balatonsees* (Vienna, 1902-6). In this work, issued by the Balatonsee Commission of the Hungarian

Geographical Society, we have, as indicated by the programme of the survey, a comprehensive monograph of the great lake of Hungary, Lake Balaton or the Plattensee—a work on the same lines as Forel's great monograph on the Lake of Geneva.

The sections of the work now before us deal with such diverse subjects as Ethnography, Archæology, Plankton, Light and Colour, etc., and one section gives a comprehensive Bibliography.

An instructive comparison might be made of the various phenomena connected with lakes as exhibited in Lake Balaton and in the Scottish Lakes. The small but deep lakes of Scotland offer the greatest possible contrast to the great but shallow Lake Balaton, and there can be no doubt that the physical as well as biological phenomena will differ profoundly.

Though comparable for size with the Lake of Geneva, Lake Balaton has a mean depth of only about 10 feet, and a maximum depth of scarcely 40 feet. In Scotland the greater lakes are relatively very deep, and there are only two even moderately large lakes which are very shallow, viz. Loch Leven and the Loch of Harray in Orkney.

Some of the subjects dealt with have but little direct relation to lakes, or they have not been studied in that relation in Scotland. A large volume is devoted to Ethnography. The shores of the Danube, which have witnessed such great movements of the human race, must yield a wealth of material for ethnological studies as compared with our ever sparsely-peopled Highlands, though the glens and the lochs are not without profound human interest, and the dwellings of long-passed races, the duns, and brouchs, and crannogs of our lochs have supplied material for various works.

The sections on biology deal with some portions of the Plankton, the Diatoms, and the Mollusca.

Dr. Entz points out that only by using the word in its widest sense can it be said that Lake Balaton has any Plankton. True plankton forms exist, but there is always a large admixture of littoral and bottom species which Dr. Pantocsek, in dealing with the Diatoms, calls pseudo-Plankton. There is an interesting chapter on the variation and the seasonal forms of *Ceratium hirundinella*. Dr. Pantocsek gives a list of nearly 300 species of Diatoms and describes very many new species and varieties. A very small number of species belong to the active plankton, and of these *Asterionella gracillima* is one of the commonest plankton organisms in Scotland, *Rhizosolenia longiseta* has been found in some lochs, but is rare, while *Fragilaria crotonensis* is frequent in the west and north of Scotland, where the beautiful variety *contorta* W. and G. S. West is found in a number of lochs.

The section on Colour Phenomena includes a chapter on Mirages of interest in Scotland in view of mirages of a very similar character observed on Loch Ness. The general effect of these mirages is to raise distant objects which are below the horizon so that they appear suspended in air over the horizon. Along a distant receding shoreline the effect is to raise the shoreline under promontories so that they have the appearance of overhanging cliffs.

We have never seen on Loch Ness the distinct duplication of the mirage by reflection which is frequent on Lake Balaton. The distant steamer was often greatly exaggerated in size in the vertical direction, and this may have been due to duplication. The receding steamer, after disappearing over the horizon, often reappeared when far down the loch. On one occasion the Fathers in the Benedictine Monastery at Fort Augustus saw a snow-covered mountain which they judged from its position to be Ben Wyvis.

Von Chohnolsy explains these mirages as arising when, the lake being warmer than the air, a layer of warmer air is formed above its surface. The great volume and depth of Loch Ness cause it to maintain a high temperature in winter, never falling below 41.0° or 42.0° Fahr. During winter the air must be generally at a lower temperature than this, especially at night; hence we have the mirages almost every morning.

ASIA.

Dr. Sven Hedin's Expedition.—According to a message from Calcutta, Dr. Sven Hedin reached Gyangtse on February 5, and expresses himself as delighted with the results of his expedition, the geographical results being especially rich. He expected to reach Shigatse at the end of February. The winter at the date of writing had proved exceptionally severe, with temperatures of 31° below zero (F.), and the whole caravan was lost crossing Tibet, but no loss of human life occurred; and the specimens, maps, notebooks, etc., were saved.

AFRICA.

The Alexander-Gosling Expedition.—Lieutenant Boyd Alexander, with the Portuguese collector José Lopez, the only two survivors of the Alexander-Gosling Expedition, recently returned to London from Africa. We have recorded here the course of the expedition up to Bima on the Welle (*see* xxii. p. 381 *et antea*), and the subsequent death of Captain Gosling, which took place in the vicinity of the Welle. From Bima it was found impossible to reach Lake Albert, as was intended, so the party turned north, and after some time had been spent among the little-known tributaries of the Bahr-el-Ghazal, the Yei was navigated down to the Nile, after which no further difficulties were encountered.

POLAR.

Scottish National Antarctic Expedition.—Information has come to hand through the British Admiralty regarding the finding of another float thrown overboard from the *Scotia*, after a drift of three years. This bottle was put into the sea on the 14th December 1903, in latitude $40^{\circ} 32' S.$, long. $58^{\circ} 33' W.$, and was found on the 13th December 1906 on the ocean beach about 10 miles SE. of the entrance of Port Philip Head, Victoria, which is approximately in latitude $38^{\circ} 18' S.$, long. $144^{\circ} 50' E.$ The float therefore travelled 9355 miles in 1095 days, *i.e.* $8\frac{1}{2}$ miles per day. This is the second float which has been found on the coast of Victoria, Australia.

New Antarctic Expedition.—Mr. E. H. Shackleton, lately Secretary of the Royal Scottish Geographical Society, is organising a new expedition to antarctic regions, which is to leave this country in October next. The plans of the new expedition, as meantime outlined, are as follows:—

On its departure the expedition will proceed to New Zealand, and thence will go down to the winter quarters of the *Discovery* in latitude $77^{\circ} 50' S$. After landing a shore party of explorers, the ship will proceed back to Lyttelton, New Zealand, thus avoiding the risk of being frozen in like the *Discovery*, and in the following year she will return to pick up the explorers.

If funds permit, the expedition will land a party of men at Mount Melbourne, on the coast of Victoria Land, and will try to reach from that point, which is the most favourable, the south magnetic pole; but the main object of the explorers is to follow out the discoveries made on the southern sledge journey from the *Discovery*.

It is held that the southern sledge party of the *Discovery* would have reached a much higher altitude if they had been more adequately equipped for sledge work; and in the new expedition, in addition to dogs, Siberian ponies will be taken, as the surface of the land or ice over which the party will have to travel will be eminently suited for this mode of sledge travelling. Further, a novel feature will be the taking of a special type of motor car suitable for use on the surface of the ice. The members of the Royal Scottish Geographical Society will cordially wish that all success may attend Mr. Shackleton's enterprise.

The Anglo-American Polar Expedition.—In our issue of November last (p. 604), it was indicated that Mr. Mikkelsen felt doubtful of being able to penetrate as far north as he had hoped on account of the bad state of the ice. A recent communication from the commander of the U.S.A. revenue cutter *Thetis*, however, indicates that the expedition was more fortunate than its leader expected. The *Duchess of Bedford* was towed into open water by a whaler in early September, and probably succeeded in reaching Banks Land before the winter.

GENERAL.

Dr. Robert Bell, of the Canadian Geological Survey, who has been a corresponding member of the Royal Scottish Geographical Society since its foundation, has recently been the recipient of the Cullum Medal of the American Geographical Society, this being the first time that this medal has been awarded to a geographer who is not a citizen of the United States. Dr. Bell was also awarded the Patron's Medal of the Royal Geographical Society of London for 1906. Dr. Bell's many friends in this country will be glad to hear of this double honour which has reached him. Dr. Bell's scientific work has extended over a period of fifty years, and is now bearing fruit, not only in the opening up of the great hinterland of Canada, but also in the increased interest which is being taken in the survey of the little-known districts of the

country, an interest which was shown in a recent resolution of the Canadian Senate.

We are glad to notice the name of **Mr. W. S. Bruce**, leader of the Scottish National Antarctic Expedition, among those who are to receive the degree of LL.D. from the University of Aberdeen.

Geographical Congresses.—We are informed that the twenty-eighth National Congress of French Geographical Societies will be held at Bordeaux this summer, beginning on July 28. The congress will coincide with the Maritime Exhibition at Bordeaux, and representatives of foreign geographical societies are cordially invited to be present.

We have also received a circular of invitation to the sixteenth *Deutschen Geographentag*, to be held at Nürnberg, from May 21st-25th next.

EDUCATIONAL.

Two recent articles by Professor A. Woeikow in *Petermann's Mitteilungen* (xi, xii.) on the distribution of population over the globe considered in relation to natural conditions and to human activity, contain much that teachers will find suggestive and useful. No geographer would, of course, deny that the distribution of man over the surface of the globe is determined broadly by geographical conditions, but he must at the same time admit that, owing to man's peculiar social characteristics, the distribution at any one period in time is not wholly determined by conditions of relief, of climate, and so forth. If we suppose that a prolific community establishes itself in some suitable region, then, if the social bonds are strong and the migratory instinct feeble, this area may become more densely populated than its resources justify, even though other suitable areas of the surface of the globe remain inadequately populated. China is, of course, the typical example of this. Professor Woeikow's articles, which are illustrated by two very striking maps, and some very useful tables, are full of interesting facts in regard to the relation between the natural conditions and the density of population.

He naturally begins by a consideration of the broad conditions, especially climate, which limit the density of population in different localities. Probably most teachers have dwelt upon man's adaptability, and pointed out that climate is on the whole more important in that it markedly affects plant-life, than for its direct effect on man as organism. The cost of his food in different climates is of course an important point, and here Professor Woeikow emphasises the need of fat in cold climates. He regards fat as the most costly element in a diet, and this fact limits the possibility of large settlements in very cold regions by greatly increasing the cost of labour. As the grass family constitutes man's great source of carbo-hydrates, his distribution is largely determined by the conditions suitable for the growth of its members.

Professor Woeikow goes on to give some detailed statistics which are very striking. If we divide the world into five regions—(1) Europe with the nearer East and North Africa, (2) Southern and Eastern Asia,

(3) Africa exclusive of the region north of the Sahara, (4) America, and (5) Australasia with the islands of the Pacific—we find that the first two include more than four-fifths of the total population of the globe, the Asiatic region having 840 millions as contrasted with the 480 millions in the European region. A glance at a map showing distribution will serve to show that the above are natural regions in that they are separated from one another by sparsely populated wastes, etc. Again, a point of much geographical interest is the fact that more than half mankind lives between 20° to 40° N. lat. Full of suggestiveness also is the fact that in the old civilisations of India and China the tendency is for the population to be uniformly distributed over the surface, while in the newer civilisations—alike in Europe and in those parts of the world which have been peopled from Europe—the tendency is for the greater part of the population to accumulate in large towns. The two maps illustrate, first, the general distribution of the population of the globe; and, secondly, the proportion of the community in the different regions which dwells in large towns, and the contrast between the two maps is striking in the extreme. As their colouring is broad and simple, it could be readily transferred to any blank map of the hemispheres for class-teaching purposes.

Teachers who have been interested in the papers on plant geography which we have published here from time to time will find much of value in an article by Mr. R. M. Harper, entitled "A Phytogeographical Sketch of the Altamaha Grit Region of the Coastal Plain of Georgia," in *Ann. of the New York Academy of Sciences*, xvii. The article may be said to be the raw material of geography, rather than geography in the strict sense, but it is full of interesting facts, and is illustrated by a series of photographs which would make admirable lantern slides for teaching purposes. The area considered is one remarkable for its geological uniformity over a large area, and with the geological uniformity comes great uniformity of vegetation. The plants of the region can be classified into a number of well-defined associations, which correspond very exactly to slight differences in soil and topography, and illustrate very precisely the value of the conception of plant-associations to the geographer. The greater part of the area is covered with Pine Barrens, in which the predominating tree is *Pinus palustris*, a light-loving tree which is sparsely scattered over the area, the individuals being separated from one another by distances of 20 or 30 feet, thus permitting an amount of herbaceous undergrowth unusual in forest areas. These Pine Barrens depend upon the presence of a loamy layer beneath a surface deposit of sand. As the loam passes gradually into an impermeable clay, and the surface is gently rolling, it follows that the low ground tends always to be swampy, and the vegetation of the Barrens passes into a swamp form, with a predominance of trees or shrubs. On the other hand, where the surface sandy layer is thick, as in the sandhills of the region, another type of vegetation, scanty in amount and xerophytic in character, appears.

NEW MAPS.

EUROPE.

ORDNANCE SURVEY OF SCOTLAND.—The following publications were issued from 1st to 30th November 1906:—One-inch Map (third edition), engraved, in outline. Sheets 29, 54. Price 1s. 6d. each.

Six-inch Maps—(Revised), full sheets, engraved, without contours. *Sutherland*.—Sheets 50, 71. Price 2s. 6d. each.

1 : 2500 Scale Maps—(Revised), with Houses ruled, and with Areas. Price 3s. each. *Caithness*.—Sheets xvii. 14 ; xviii. 7, 8, 16 ; xix. 1, 4, 5, 8, 9, 10, 11, 12, 13, 14 ; xx. 9, 13 ; xxiii. 1, 3, 7, 13 ; xxiv. 1, 2, 3, 5, 6, 7, 8, 11, 12, 16 ; xxv. 1, 2, 9, 10, 13 ; xxviii. 10, 14, 15 ; xxix. 3, 4, 7, 8, 12, 13, 15, 16 ; xxx. 1, 5, 9 ; xxxiii. 2, 3, 4, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16 ; xxxiv. 1, 2 (3 and 4), 5, 6, (7 and 11), 9, 10, (13 and 14) ; xxxix. 5, 6.

Note.—There is no coloured edition of these Sheets, and the unrevised impressions are withdrawn from sale.

The following publications were issued from 1st to 31st December 1906 :—One-inch Map (third edition), engraved, in outline. Sheets 43, 45. Price 1s. 6d. each. Third edition, engraved, with Hills in brown or black. Sheets 2, 5, 29, 36, 40, 43, 45, 46, 54, 60. Price 1s. 6d. each. Third edition, printed in colours and folded in cover, or flat in sheets. *Stirling*.—Sheet 39. Price—on paper 1s. 6d. ; mounted on linen 2s. ; mounted in sections 2s. 6d.

Six-inch Maps (Revised), full sheets, heliozincographed, with contours. *Ross and Cromarty*.—Sheet 42. Price 2s. 6d.

1 : 2500 Scale Maps (Revised), with Houses ruled, and with Areas. Price 3s. each. *Caithness*.—Sheets xxv. 5, 6 ; xxxix. 1, 2, 3, 9, 10, 13 ; xlii. 4, 8, 11 (12 and 16), 15 ; xliii. 1. *Edinburghshire*.—Sheets x. 8, 11, 12 ; xi. 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15 ; xvii. 2, 3. Sheets x. 4, 7, 10 ; xvii. 1. Price 1s. 6d. each.

Note.—There is no coloured edition of these Sheets, and the unrevised impressions are withdrawn from sale.

The following publications were issued from 1st to 31st January 1907 :—Six-inch and larger Scale Maps.—1 : 2500 Scale Maps (Revised), with Houses ruled, and with Areas. Price 3s. each. *Edinburghshire*.—Sheet xi. 1.

Note.—There is no coloured edition of these Sheets, and the unrevised impressions are withdrawn from sale.

GEOLOGICAL SURVEY OF SCOTLAND.—The following publications were issued from 1st to 31st December 1906 :—One-inch Map. Sheets 13, 21 (Drift Edition). Price 4s. each.

MEMOIRS.—The Oil Shales of the Lothians. Part I.—The Geology of the Oil-Shale Fields : by H. M. Cadell, B.Sc., F.R.S.E., and J. S. Grant Wilson. Part II.—Methods of working the Oil-Shales : by W. Caldwell. Part III.—The Chemistry of the Oil-Shales : by D. R. Stewart, F.I.C. Price 4s.

UNITED KINGDOM.—GENERAL MEMOIRS.—Summary of Progress of the Geological Survey of the United Kingdom and Museum of Practical Geology for 1905. Price 1s.

ADMIRALTY CHARTS, SCOTLAND.—Loch Kishorn and the Approaches to Loch Carron. Surveyed by Captain Morris H. Smyth, R.N., in H.M. Surveying Ship *Research*, 1904-5. Scale, 1 : 10,600. Published Nov. 1906. Number 3564 (3644). Price 3s.

Loch Dunvegan, including Bay. Surveyed by Captain Morris H. Smyth,

R.N., in H.M. Surveying Ship *Research*, 1905. Scale, 1 : 15,630. Published Dec. 1906. Number 3601 (3653). Price 3s.

Presented by the Hydrographer, The Admiralty, London.

IRELAND.—Map showing the Surface Geology of Ireland, reduced chiefly from the Ordnance and Geological Surveys under the direction of Sir Archibald Geikie, D.Sc., LL.D., F.R.S., late Director-General of the Geological Survey. Topography by J. Bartholomew, F.R.G.S. Scale 1 : 633,600 or 10 miles to an inch. Price 6s., mounted on cloth and in case.

John Bartholomew and Co., Edinburgh.

This map, complete in one sheet, is a minute and accurate reduction of the sheets of the Geological Survey. The drift and surface geology as here shown ought to be of much practical value and interest to agriculturists.

ASIA.

ASIA.—Stanford's New Orographical Map of Asia. Compiled under the direction of H. J. Mackinder. Scale 1 : 8,721,500. In four sheets. 1906. Price 16s., or 20s. mounted on rollers and varnished.

Edward Stanford, London.

An effective school wall-map. The relief of the land is shown by contour lines and tinted in shades of brown; the depths of the surrounding seas are shown by shades of blue. The lettering shows both physical and political features.

CHINA.—General Staff Map of the Province of Chih-Li (southern sheet). Scale 1 : 1,000,000 or about 16 miles to an inch. 1906. Price 2s.

Topographical Section, General Staff, London.

CHINA.—General Staff Map of the Province of Ho-Nan. Scale 1 : 1,000,000 or about 16 miles to an inch. 1906. Price 2s. 6d.

Topographical Section, General Staff, London.

AFRICA.

AFRIKA.—Justus Perthes' Wandkarte von Afrika zur Darstellung der Bodenbedeckung mit 8 Kärtchen zur Entdeckungsgeschichte und 14 Bildnissen berühmter Afrikaforscher. Bearbeitet von Paul Langhans. Scale 1 : 7,500,000. Preis, 9 Mark.

Justus Perthes, Gotha.

This effective map, composed of the plates from Stieler's Atlas, is coloured to show the characteristic land-surface features, with political colouring superimposed in narrow bands. A series of inset maps shows the progress of exploration during the nineteenth century. The interest of the map is further enhanced by portraits of the leading explorers.

EGYPT.—Bartholomew's Tourist Map of Egypt and the Lower Nile, prepared from the latest surveys. Scale 1 : 1,000,000 or 16 miles to an inch. With inset maps of Alexandria, Cairo, and Upper Egypt. Price 3s. Mounted on cloth.

John Bartholomew and Co., Edinburgh.

This map extends from the Delta to Wady Halfa. For a general map of Egypt there is nothing more complete than this new map.

BAHR EL GHAZAL.—General Staff Map on Scale of 1 : 1,000,000, or about 16 miles to an inch. 1906. Price 2s.

ORANGE RIVER.—(Provisional) General Staff Map on Scale of 1 : 1,100,000, parts of Sheets 127 and 128.

Topographical Section, General Staff, London.

EAST EQUATORIAL AFRICA.—Anglo-German Boundary, Triangulation Charts of the British Commission, in 3 Sheets. Scale 1 : 400,000. 1906.

Topographical Section, General Staff, London.

SIERRA LEONE.—General Staff Map on Scale of 1 : 250,000, or about 4 miles to an inch. Sheets—Sherbro Island, Freetown, Falaba, Panguma, Karina, Banda-Juma. 1906. Price 1s. 6d. each Sheet.

UGANDA.—General Staff Map on Scale of 1 : 250,000, or about 4 miles to an inch. Sheets—86-A, 86-E, 86-I, 86-M, 86-N. 1906. Price 1s. 6d. each Sheet.

Topographical Section, General Staff, London.

AMERICA.

CANADA.—Standard Topographical Map. Scale 1 : 250,000 or about 4 miles to an inch. Sheets 1 NW. and 1 NE., Guelph, Ontario. James White, F.R.G.S., Geographer. 1906.

Department of the Interior, Ottawa.

UNITED STATES GEOLOGICAL SURVEY.—Geologic Atlas—Redding Folio, California; Dover Folio, Delaware and Maryland; St. Mary's Folio, Maryland and Virginia; Snoqualmie Folio, Washington; Milwaukee Special Folio, Wisconsin. Price 25 cents each folio.

United States Geological Survey, Washington, D.C.

ATLASES AND WORLD MAPS.

THE M.P. ATLAS.—A Collection of Maps showing the Commercial and Political Interests of the British Isles and Empire throughout the World. 1907. Price 25s. net. *W. & A. K. Johnston, Limited, Edinburgh and London.*

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A Grammar of the Bema Language as Spoken in North-East Rhodesia. By Rev. Father SCHOEFFER. Edited by J. H. WEST SHEANE, B.A. (Camb.) Arranged, with Preface, by A. C. MADAN, M.A. Extra fcap. 8vo. Cloth. Pp. 72. Price 2s. 6d. net. The Clarendon Press, Oxford, 1907.

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The Harz: The Most Beautiful Mountain Region of Northern Germany. With an Introduction by HANS HOFFMANN of Weimar. Pp. 109. Rud. Stolle, Bad Harzburg, 1905.

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Gravesend: The Water-gate of London, with its Surroundings. By ALEX. J. PHILIP. Cr. 8vo. Pp. 128. Price 1s. net. The Homeland Association Ltd., London, 1907.

Report on the Dominion Government Expedition to Hudson Bay and the Arctic Islands on board the D.G.S. "Neptune," 1903-4. By A. P. LOW, B.Sc., F.R.G.S. Demy 8vo. Pp. xviii + 355. Geological Survey, Ottawa, 1907.

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Also the following Reports, etc.:—

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Central Province District Gazetteers. Edited by R. V. RUSSELL, I.C.S. Allahabad, 1906.

Facts about New Zealand. Pp. 21. Issued by New Zealand Department of Tourist and Health Resorts. Wellington, 1907.

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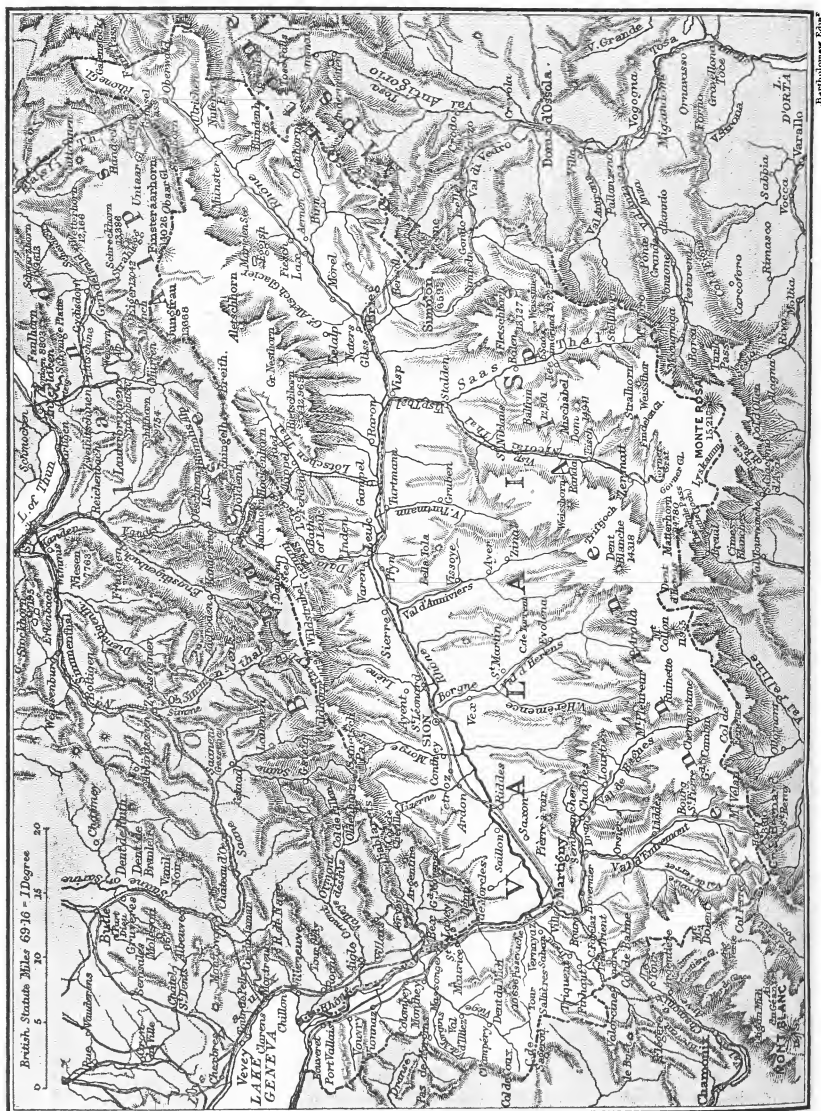
THE SCOTTISH GEOGRAPHICAL MAGAZINE.

THE SWISS VALAIS: A STUDY IN REGIONAL GEOGRAPHY.

By MARION I. NEWBIGIN, D.Sc. (Lond.).

(With Maps and Illustrations.)

THE Canton Valais is a region famous not only for that beauty of scenery which year by year attracts an increasing number of visitors, but also because of its great scientific interest. In a previous paper (xxii. p. 285) there was published here a study of a Scottish region, which is remarkable for its cool, damp climate, and for the antiquity of the land surface. The Highland area has been for a prolonged period a land surface, and its mountains and rivers have long since passed into geographical old age. It is far otherwise with the area now to be considered. In its present form the Swiss Valais is of geologically recent origin, and its rivers and mountains are only in process of settling about a position of equilibrium. Every here and there one may perceive indications of this fact in the landslips which—old or new—disfigure the mountain-sides, and the same evidence of immaturity is to be discerned in the river-systems. Very different also is the climate, and with climatic differences come differences in natural products, and in the whole mode of life of the inhabitants. Further, the geologically recent origin means that the rocks of the Valais are of quite different type from those which cover such vast areas in the Scottish Highlands, and this naturally produces a difference in the soil which is of great geographical importance. Again, while the Highlands have been isolated from the dawn of history, the Valais, to some extent at least, has always served as a route between the countries to the north and south of the Alps, and finally, while the Highland area shows merely traces of a past glaciation, much of the Valais is still in the Glacial period, so that the contrasts are many and obvious.



The Canton Valais has an area of 5220 kilometres,¹ 2015 square miles, and may be described in brief as including the upper Rhone valley from the source of that river to its entrance into Lake Geneva. The accompanying map shows the boundaries in detail. It will be seen that, roughly speaking, the canton is bounded to the south by the great chain of the Pennine Alps, including the highest mountains of Switzerland, and to the north by the great mountain wall of the Bernese Alps. The southern and eastern boundaries of the canton are formed by the Italian frontier, the western by the frontier of Savoy, which debouches on the Lake of Geneva at St. Gingolph. The northern boundary is formed by the Rhone itself, from its entrance into the lake to the vicinity of Evionnaz, and then by the watershed of the Bernese Alps.

Within this area the course taken by the Rhone is very striking. Beginning at its origin at the Rhone glacier we have first a steep Alpine stretch, extending in a north-east to south-west direction down to the town of Brig. At Brig the river bends somewhat to the west, but runs with a general south-west direction down to Martigny. Throughout this second region the valley floor is wide and flat, and has evidently at no very distant period lodged one or more lakes. The flat valley bottom is still very liable to flooding, and to obviate the risk of inundation the towns are built for the most part on the cones brought down by the lateral streams. At Martigny the river takes a sharp bend—the “elbow” of the Rhone, and turning almost at right angles to its previous course, runs north-west to the Lake of Geneva. With this change of direction the river valley changes its form, seems to break through between the great mountain masses of the Dent du Midi and the Dent de Morcles, and forms a narrow, steep-sided gorge, which in the vicinity of St. Maurice is a mere defile, so narrow as to be readily fortified. Between St. Maurice and Bex the character of the valley again alters, and we enter upon a flat swampy area which is obviously merely a silted-up part of the bed of the lake. It may be well to emphasise here the existence of these different regions in the valley, for the climate and therefore the products of each show considerable variations. To sum up briefly: from the present boundary of Lake Geneva to beyond Bex we have a wide, swampy, flat area, which is geographically part of the lake region; then comes a narrow region, running north-west to south-east, too narrow to be fully warmed by the sun, and fully exposed to the cold north-west winds which sweep up it from the Jura; then a wide, sheltered, warm area, almost Italian in character, stretching from Martigny upwards to the vicinity of Brig, and there passing into the Alpine region, naturally colder, which ends with the birth of the infant Rhone from its great glacier. Now the characters, whether of climate, of the natural flora, or of the cultivated plants, which can be definitely stamped as typically Valaisian are confined to the warm stretch from Martigny upwards, and to the larger lateral valleys opening into it.

¹ Erich Uetricht, *Die Ablation der Rhone in ihrem Walliser Einzugs-gebiete im Jahre 1904-1905*. Inaugural-Dissertation der Philosophischen Facultät Bern z. Erlangung d. Doctorwürde, Berne, 1906. Abstract in *La Géographie*, xv. p. 37. Reclus gives the figure as 5257 kilometres (*Nouvelle Géographie Universelle*, iii. p. 127).

A glance at the map will show that the crest of the Bernese Alps is much nearer the Rhone than the crest of the Pennines, or, in other words, that the northern lateral valleys are short and steep, while the southern valleys are much longer. It is a natural consequence that the human habitations for the most part occur in the southern valleys, the northern valleys being much more sparsely populated. One reason is, of course, that as temperature diminishes with elevation a larger area is available on the south side for the growth of crops, or of grass, than on the steep northern side. Those areas of natural grass, growing at high elevations, which in Switzerland are called *alps*, are indeed few on the northern side, and as we shall see, the economic life of the Valais is based in large part upon these *alps*. We shall in consequence be chiefly interested here in the southern valleys. Without stopping to consider these tributary valleys in detail, it may be well simply to mention one or two of the lateral streams, as of some of these we shall have much to say later.

In general, on the northern side the drainage is in an undeveloped state, consisting for the most part of short swift streams, debouching independently into the Rhone. On the other hand, on the south side the drainage is more developed, and the differential growth of the streams has resulted in various cases of river capture. In other words, one stream which, by reason of its larger catchment area, or the softer rocks of its bed, has had more excavating power than its neighbours, has been able to tap the upper tributaries of adjacent streams, and has thus constantly increased at the expense of its neighbours. The result is that on the south side there are a few considerable streams, with tributaries also of considerable size, as well as some small streams without large tributaries. The chief streams of the southern bank of the Rhone in the area under consideration are the Visp, which drains the two valleys in which lie the health-resorts of Zermatt and Saas; the Navigenze, draining the Val d'Anniviers; the Borgne, draining the Val d'Hérens; the Dranse, draining a collection of valleys, of which the most important are the Val de Bagnes and the Val d'Entremont, which leads up to the St. Bernard Pass; and the Vièze, which drains the Val d'Illiez. On the north bank we need only meantime notice the Dala, which drains the valley in which lies Leukerbad, and the Lonza, draining the Lötschenthal.

It is not necessary for our purpose to describe in detail the course of these valleys, or to discuss the mountain groups in which they respectively arise, but something may be said of the great means of communication in the Canton. Such historical importance as a highway as the upper Rhone valley possesses, is due to the fact that not a few of those deeply excavated southern valleys of which we have just spoken afford access to depressions in the great barrier of the Pennine Alps, and thus permit of communication between Italy and Central Europe. The two most important passes are of course the Simplon to the east, and the St. Bernard in the more western part of the Canton. As the map recalls, the great Simplon road has now been functionally replaced by the railway tunnel. Until the opening of this tunnel in 1906, the Rhone

valley line, it will be remembered, stopped at Brig, but connected at Visp with the Zermatt line. The traffic carried by the line of the main valley, and by the branch to Zermatt, was, previous to the opening of the tunnel, almost entirely tourist traffic. Almost, but not entirely, for there is a considerable amount of movement of workmen from one side of the chain to the other. It is because of this movement that we have on the other great pass, the St. Bernard, the Hospice, which is not, as the tourist is apt to suppose, merely for his benefit in the summer months. The summit of the Simplon Pass lies at a height of 2009 metres (or 6565 feet), while that of the St. Bernard is 2472 metres (or 8111 feet), the elevation in both cases being too great to permit either to have any significance as a trade route, though the significance of the latter as a highway is suggested by the fact that it is estimated that some 25,000 persons cross the pass annually, only a small proportion of which are tourists. In addition to these famous passes, there are a number of others; indeed from almost any one of the longer valleys a passage may be forced to Italy or Savoy. Most of these passes are, however, of minor importance, except as regards tourist traffic. The best known is, perhaps, the Théodule, a glacier pass rising to 3322 metres (or 11,984 feet), which has been used certainly since the Middle Ages, and is constantly crossed in summer time.

On the north side the passes are fewer, and from the nature of the case are less important. The best known is the Gemmi, and there can be no doubt, as is pointed out by Christ in his *Pflanzenleben der Schweiz*, that the tourist who wishes to fully appreciate the peculiarities of the mountain-locked Valais, should enter it from the Gemmi. As the traveller stands on the summit of the precipitous Gemmiwand, he sees before him the whole range of the Pennine Alps with their summits of dazzling whiteness, and at their feet the deep valley; and he sees also another sky, and other colouring, than that which he left behind at Kandersteg. The light is brighter, the insolation greater, the air drier; the whole aspect of the flora is southern instead of northern in type. In short, to cross the Gemmi is to cross in a few hours' walk from north to south Switzerland, is to obtain a foretaste of the sensation which one feels on standing on some summit of the Pennine Alps and looking down upon the valleys of sunny Italy. The upper Rhone valley, which has been called the Spain of Switzerland, is indeed almost a displaced part of the Mediterranean lands.

The special point, however, which these brief notes on the passes are intended to suggest is, that although passes of varying degrees of difficulty do cross the ring of mountains which almost surrounds the Canton Valais, yet the area is one of economic isolation. From its geographical peculiarities it is clear that if it prospers it must be owing to its own products, not because it can ever serve to a great extent as a highway for trade. A true mountain region, with a high mean elevation of the surface, the peculiar course of the Rhone makes it even more completely surrounded by mountains than an ordinary river-valley can be.

As the "elbow" has also a marked effect upon climate, a few words

should be said as to its cause. Without going into geological details, it may be sufficient to say that there is reason to believe that the valley from Martigny to the lake, *i.e.* from the elbow downwards, is very old, much older than the portion above Martigny. It was probably formerly occupied by the river Dranse, the large tributary of the Rhone which enters at Martigny. It appears probable that the Dranse occupied this valley before the formation of the Bernese Alps, and the folding near St. Maurice. As the land rose slowly, the Dranse was able to excavate for itself a passage as elevation occurred, and there was thus formed the gorge now found near St. Maurice. Above Martigny the Rhone runs in a great longitudinal fold, which runs north-east and south-west beyond the points where the Rhone ceases to occupy it. At Martigny the Rhone quits this fold to avail itself of what was once the valley of the Dranse.

One other point about the drainage system may be noted, and that is that there is a remarkable discordance, throughout much of the Valais, between the Rhone and its lateral tributaries. It is a familiar fact that in what may be called a normal river system the lateral streams grade gently into the main streams. In a recently glaciated area, on the other hand, the side streams often run throughout their course at a considerable elevation above the main valley, and either precipitate themselves finally into the main valley by a waterfall, or series of rapids, or, if their excavating power is great, lie for the last part of their course in deep gorges. Discordance of this kind is expressed by saying that the tributaries run in "hanging valleys," or the same thing may be expressed by saying with the Germans that the main valley is *over-deepened* as compared with the lateral. Many but not all geologists, as is well known, ascribe this condition to the effect of ice. It is not necessary to enter upon the question of causes here, but we may point out the frequency of hanging valleys in the Valais, especially in the lower part of the Rhone valley. As has been already pointed out here (xxii. p. 648) the fact has an important bearing upon the distribution of human habitations in the side-valleys, for it renders the basal steep portion of the valley useless to man, and greatly increases the difficulty of access to the upper approximately level parts. On the other hand, the steepness somewhat facilitates the task of the geographer, for it causes a rapid diminution of temperature, a correspondingly rapid change in natural products, and thus makes it easy to distinguish geographically between the Alpine parts of the side valleys above, and the warm floor of the main valley below. Another result is that as the glacier-fed streams descend to the Rhone valley they naturally deposit much of their load of *débris* as soon as their velocity is checked, and the result is the formation of the large cones, which are very conspicuous in parts of the Rhone valley. Fuller particulars as to these cones will be found in Lord Avebury's *Scenery of Switzerland and the Causes to which it is due*, which may be referred to for further details as to the origin of the Rhone valley.¹

¹ See also Maurice Lugeon's *Quelques mots sur le groupement de la population du Valais*—Abstract in *Annales de Géographie* (1902), xi.

THE CLIMATE OF THE VALAIS.

We cannot profitably consider the vegetation of the Valais without first considering the climate, which determines the nature of the vegetation.

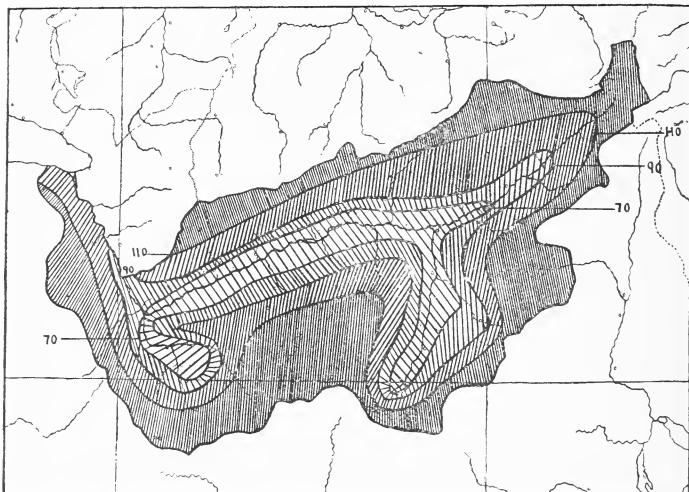
It will be recollected that the Alps have a general east-to-west trend, and in consequence, in the language of meteorology, they form a temperature but not a rainfall divide. The meaning of this statement is easily realised. Looked at from the Italian side the great chain forms a barrier shutting out the cold winds of the north from the sunny south, or, more exactly, the cold air from the north is warmed by compression before it reaches the lower ground, and thus, in Hann's words (*Handbuch der Klimatologie*) they constitute the dividing line between the sub-tropical climate of the Mediterranean area and the temperate climate of Central Europe. On the other hand, as the rain-carrying winds come from the west, *i.e.* are transverse to the chain, the Alps have not a rainy and a dry side, as have north-to-south trending mountains like the Rocky Mountains. But though these statements are generally true, yet the emphasis which has been already laid upon the mountain ring which encircles the Valais, paves the way for the further statement that as regards temperature, part of the Valais approaches the Mediterranean rather than the Central European area, while it has further an unusually low rainfall for a mountain area. Thus Zermatt, at a height of 5315 feet (or 1620 metres) above sea-level, has a rainfall of 65 cm., that is approximately the same as that of Leith (26 inches) which is virtually at sea-level. The climate is not uniform, and varies not only with the height, which is only to be expected, but also according to the direction of the part of the Rhone valley considered, the mountain-locked portion from Martigny upwards having a hotter and drier climate than the portion from Martigny to the lake, which is swept by the cold, rain-bearing, north-west winds.

MEAN ANNUAL RAINFALL OF STATIONS IN THE VALAIS, 1895-1904.

1. RHONE VALLEY.			2 SOUTHERN VALLEYS.			3. NORTHERN VALLEYS.		
Station.	Height in m.	Rain- fall in cm.	Station.	Height in m.	Rain- fall in cm.	Station.	Height in m.	Rain- fall in cm.
Martigny,*	480	71	Champéry,*	1052	164	Varen,	750	62
Riddes,*	492	49	Orsières,*	890	63	Leukerbad,	1415	100
Sion,	540	64	St. Bernard,*	2478	149	Kippel,*	1376	93
Sierre,	551	57	Evolena,*	1378	87			
Brig,	678	68	Grächen,	1632	55			
Fiesch,*	1080	89	Zermatt,	1613	69			
Reckingen,*	1349	108	Saas Grund,*	1562	85			
Oberwald,	1370	148	Binn,*	1390	102			

The mean, in the case of stations marked *, is based upon a shorter period than ten years, figures not being available in these cases for the whole period 1895-1904.

Some of the general features of the region as regards rainfall may be gathered from the accompanying map which is based upon the table, this having been obtained from the figures given in the *Annalen* of the Swiss Meteorological Bureau for the last ten years available. The map shows first that over an area which extends up the Rhone valley from about Martigny to Brig, and sends prolongations up the valleys of the Visp and the Dranse there is, as it were, an island of low precipitation, where the rainfall is less than 70 cm. (or $27\frac{1}{2}$ inches) per annum. Outside of this, and extending up to Fiesch in the main valley is a region which has a fall beneath 90 cm. (or 35 inches) per annum. Into the next region, that with a rainfall exceeding 90 cm. but less than 110



Mean Annual Rainfall of Valais, 1895-1904. The figures are cubic centimetres.

cm. (or 43 inches), comes not only the higher ground on either side of the upper portion of the Rhone valley, but also that part of the valley which is included between Martigny and Lake Geneva. The very high ground, *i.e.* that represented by the stations near the crest of either the Pennine or Bernese Alps, has a rainfall exceeding 110 cm. per annum. The point which it is desired to emphasise is that in the Valais rainfall is not directly dependent upon height. If one ascends the valley from Martigny one finds the precipitation gradually diminishing until it reaches a minimum at Riddes or Sierre, and beyond that point again increasing. Roughly speaking, all the places below the elbow of the Rhone have a higher rainfall than the places above, and this is true both of the side valleys and of the main. Thus Champéry in the Val d'Illeiez, at a height of 1052 metres, has a rainfall about two and a half times greater than that of Zermatt at 1620 metres.

The reason of this curious distribution is not far to seek—it is found in the varying direction of the Rhone valley upon which stress has already been laid. As we shall see later, the greater precipitation of the lower part of the valley as compared with the upper is associated with a lower temperature, and the causation in both cases is the same—up to Martigny the valley is exposed to the cold, rain-carrying north-west and west winds which sweep across from the Jura, while the bend at Martigny makes these winds rare in the upper part of the valley. Above Martigny these are replaced by the warmer, drier south-west wind, which enters the valley after blowing over elevated ground, and therefore with something of a foehn effect. The following figures illustrate the connection of high temperature and low precipitation with the predominance of the south-west wind in the Rhone valley. As recent figures are not available for a ten years' period, two periods of three and four years have been taken.

CLIMATIC FACTORS FOR SIERRE AND BEX.

PERIOD 1895-1897.				
	Height of Station.	Mean Rainfall.	Mean Annual Temperature.	Prevailing Wind.
Sierre, .	551 m.	71 cm.	9° C.	SW.
Bex, .	426 m.	99 cm.	8·8° C.	NW.
PERIOD 1901-1904.				
Sierre, .	551 m.	53 cm.	9·3° C.	SW.
Bex, .	426 m.	94 cm.	9·2° C.	W.

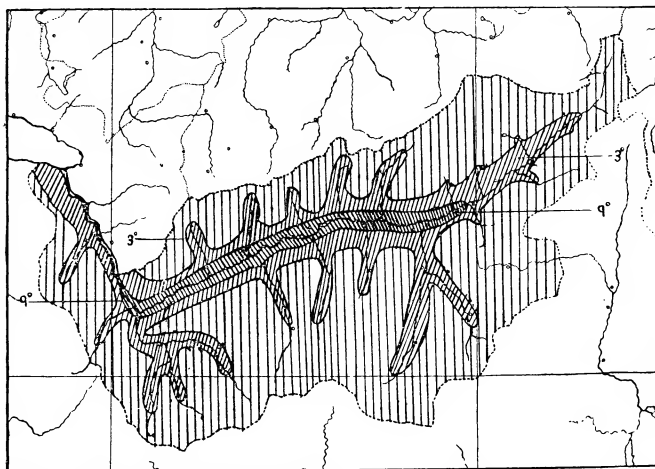
It will be noticed here that the lower station Bex is slightly colder and much wetter than the higher, a reversal of the typical conditions in valleys. It would appear that the south-west wind prevails through all the warmer part of the upper Rhone valley, but in the Alpine region is replaced by other winds determined by the trend of the part of the valley considered. At Reckingen, with a rainfall of over 100 cm. (five years' mean) the prevailing wind is west. The heavy rainfall is due to the warm, moist wind which comes up the valley. The relation between rainfall and wind is prettily shown by the distribution of the beech, which, according to Christ, extends as far up the Rhone valley as the westerly wind from Lake Geneva penetrates, *i.e.* throughout the area where the damp lake climate prevails (see map, p. 190). In other words, it extends up the valley to a point approximately midway between Martigny and Sion, where the dry warm winds cause its disappearance.

The other three maps illustrate the temperature conditions, and are again based upon a ten years' mean. The three maps show respectively the mean annual, the mean January, and the mean July temperature. Taking the mean annual first, we find that there is an area with a mean of over 9° C. which extends from about Martigny nearly as far as Brig. The next area, that including temperatures between 9° and 3°, includes not only the higher parts of the main and side valleys, but also the lower part of the main valley. Finally, the great elevations have a mean annual temperature of below 3°. The two other maps (p. 180) show that

MEAN MONTHLY TEMPERATURES OF CERTAIN STATIONS IN THE VALAIS,
1895-1904, COMPARED WITH THE MEAN MONTHLY TEMPERATURE
AT KINGUSSIE.

Name of Station.	Height above Sea-level.	Mean Monthly Temperatures—Centigrade.											
		Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
	Metres.	°	°	°	°	°	°	°	°	°	°	°	°
Sierre,	551	-0.8	2.4	5.3	9.9	13.7	17.4	19.5	18.0	15.2	9.5	4.1	0.0
Leukerbaul,	1415	-2.6	-2.3	2.7	3.9	7.6	12.1	14.3	13.4	10.9	6.2	2.0	-1.7
Zermatt,	1613	-6.0	-5.2	1.9	2.2	6.4	10.5	12.7	10.6	9.0	4.1	-0.8	-5.1
St. Bernard,	2475	-8.3	-8.1	-6.9	-3.6	-0.2	4.0	6.9	6.5	4.3	-0.7	-4.2	-7.2
Kingussie,*	251	1.9	2.2	2.9	5.2	8.9	11.9	13.3	12.9	10.7	7.0	3.8	2.4

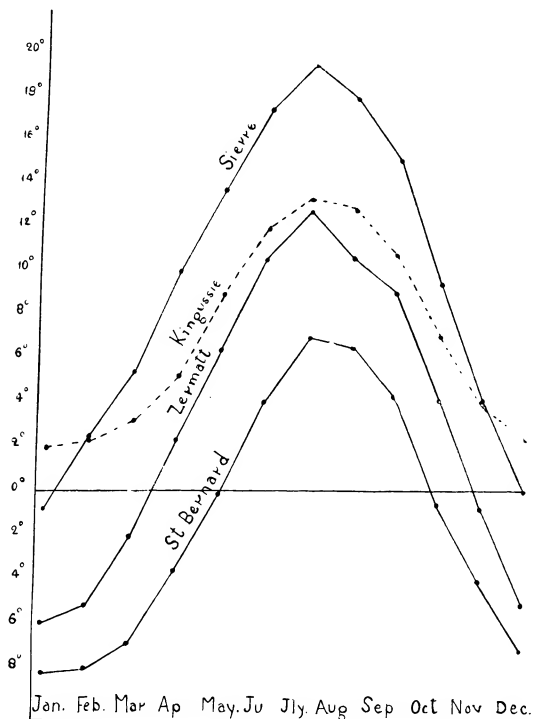
* The figures for Kingussie are taken from Dr. Buchan's paper on "The Mean Atmospheric Temperature of the British Islands," *Jour. Scott. Meteorol. Soc.*, Series III., xiii. and xiv., p. 3, and are converted to Centigrade.



Mean Annual Temperature of Valais, 1895-1904. The figures are temperatures, Centigrade.

the favoured area of the Rhone valley above Martigny is both hotter in summer and less bitterly cold in winter than would *à priori* be expected from the elevation. In order to bring out some features of the annual march of temperature as compared with that of our own country the

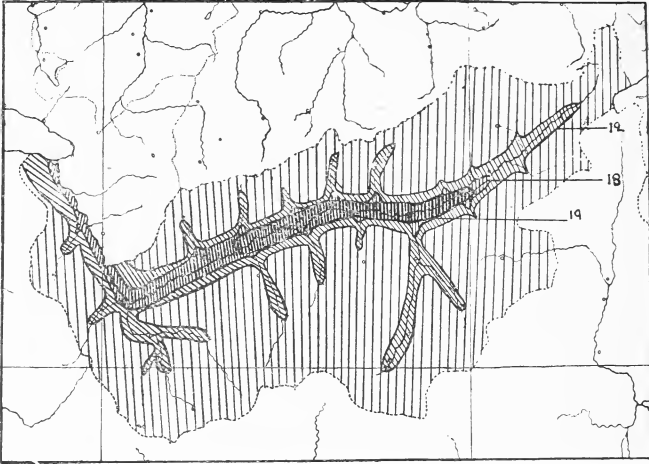
accompanying curve has been constructed which contrasts the mean monthly temperatures of certain places in the Valais with the typically Highland area of Kingussie. The figures upon which the diagram is based, as well as the mean monthly temperature of Leukerbad, are given in the table. The point which the diagram specially illustrates is that, as contrasted with the insular climate of Kingussie, the climate of the



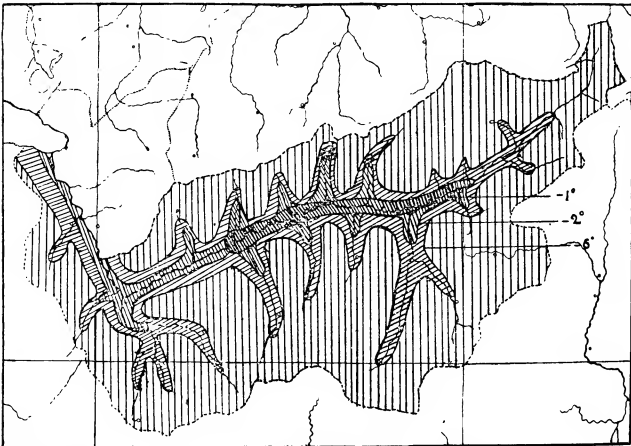
Mean Monthly Temperatures of three stations in the Valais, 1895-1904, compared with those of Kingussie. The temperatures are Centigrade.

Valais is typically continental. This is well shown in the sudden rise and fall of the curve in spring and autumn. Many plants which flourish at, for instance, Sierre, will not grow at Kingussie, not, as is sometimes supposed, because of the winter cold at the latter place—it is in point of fact much colder in winter in the Valais—but because spring when it comes is no laggard but comes swift-footed and sure. In the Highlands the rise of temperature is slow and fluctuating, mild days and bitterly cold ones often alternating. The consequence is that the plants

are tempted one day to begin active life, and the next are nipped with the frost. In the Valais they are protected with snow and condemned



Mean July Temperature of Valais, 1895-1904. The figures are temperatures, Centigrade.



Mean January Temperature of Valais, 1895-1904. The figures are temperatures, Centigrade.

to forced inactivity until with a rush spring comes triumphant once for all over the forces of winter.

Another interesting point which the diagram shows is that, con-

trasting places of increasing height above sea-level, we find that the temperature gradient is steepest in the lowest places and least steep in the higher. This is very marked when the St. Bernard gradient is contrasted with the Sierre one. Zermatt, which is intermediate in height between the two, is also intermediate in this respect also. This is a general characteristic of mountain resorts, which tend to approach nearer the insular type of climate than places in the valleys.

The reason for this is interesting. The first point to be noticed is that the difference of temperature due to elevation is much greater in summer than in winter. In December, for instance, the curves for Zermatt and Sierre approach one another much more closely than in July, the actual difference of mean being 5.1° in the first case, and 6.8° in the other. Even more marked is the difference in the case of the St. Bernard and Zermatt figures, for it is there 5.8° in July, and only 2.1° in December. The causation is to be found in the so-called inversions of temperature,¹ which are frequent in Alpine regions. Under ordinary circumstances temperature diminishes with elevation, but in mountain regions during calm, clear weather in winter, it frequently happens that the valley floors are colder and damper than a region on their walls. In ascending from the valley floors at these times, one passes into a warmer region, and on ascending still higher, comes again to a cold stratum. These inversions are so frequent that they affect the mean temperature in the winter months, and produce the appearances noted above, that is, they lessen the steepness of the curve showing the annual march of the temperature. For a detailed account of the cause of the inversion, reference should be made to Hann's *Handbuch*, but it may in general terms be given as the result of the tendency for the cold, heavy air to sink to the bottom of the valley, while the warm air rises. These inversions have an interesting effect on the life of the inhabitants, both of the Valais and of the Alps generally. First of all they render the flat valley floors, which are of course often old lake beds, very unsuitable for human habitations. There is throughout the Alps a general tendency for the houses to be placed on the walls of the valleys rather than on the floor, because experience has shown that an elevation of even a few metres may cause a considerable rise of temperature in autumn and winter. Again, in the Valais where the temperature conditions are favourable, the frequency of autumnal inversions makes it possible for the inhabitants to ascend to considerable elevations and yet enjoy comparatively warm temperatures. Something was said of these autumn and winter migrations in a particular valley in a previous article published here (xxii. p. 648).

It may be repeated that these inversions are local to the valleys concerned, and are therefore only suggested by the curves given above. To prove their existence it would be necessary to take a series of temperature readings at different heights in the same valley. Such readings have been taken and examples are quoted by Hann and Kerner.

¹ See Hann's *Handbook of Climatology*, Part I., translated by Ward, p. 252 *et seq.*, and Kerner in *Zeitschrift d. oesterr. Gesellschaft f. Meteorologie*, xi. (1876), p. 1 *et seq.*

One other point is worth mention. It will be noted that the diagram shows that the summer temperature of Kingussie is actually higher than that of Zermatt. To any one who has experienced both climates this may seem absurd. One may spend a whole summer in the Highlands and hardly find a day when it is possible to sit for long out of doors in comfort, while at Zermatt for day after day the temperature may be almost intolerably hot. The explanation is of course to be sought in the difference of insolation due to altitude. According to figures quoted by Hann (*op. cit.*, p. 232), while at Whitby the difference between the sun and shade temperature is only 5.6° , on the Gornergrat it is no less than 32.8° , and at the Riffelberg it is 21° . In consequence, on a clear day one may bask in the sunshine on the Gornergrat at a height of 3140 metres above sea-level in spite of the proximity of ice and snow. The figures given in the table are of course shade temperatures.

To return to the general temperature conditions in the Valais, it must not be supposed that the unusual conditions of warmth in the upper Rhone valley upon which so much stress has been laid, are solely due to shelter from cold winds, or to the warming and drying of the air by compression as it descends from the mountain crests. The direction of the valley, which allows the sun to shine for a much longer period than would be possible in an east-to-west valley, is an important factor, as is also the width of the valley. Throughout Switzerland, as all tourists know, the actual, as distinguished from the theoretical, climate of a valley, depends upon the amount of its exposure to the sun. Thus in the Valais the difference between the temperature of Leukerbad, on the north side and thus facing south, and of Zermatt in a south trending valley is greater than the difference of elevation warrants. There are, however, some interesting facts, in regard to the temperature conditions at Zermatt, which we shall have to consider later in connection with the distribution of woods in the Valais.

Something has already been said of the winds of the Valais; it only remains to say a few words in regard to that curious wind known as the foehn. The foehn is a warm dry wind which blows, sometimes with great violence, from a southerly or south-easterly direction in certain of the Swiss valleys, and is often of great importance as the melter of the winter's snow and therefore as the harbinger of spring. The causation has been shown to be the existence of a barometric depression in a line between Ireland and the Bay of Biscay, which causes the air to be sucked out of the Alpine region. As the mountain wall of the Alps prevents any direct movement of air from the south, the air over the crest of the ridge is drawn down to the valleys to fill the place of that which has travelled westward. This air is warmed and dried by compression as it descends, and appears in the deep valleys as the hot, dry, enervating foehn. Now, owing to its trend, the upper Rhone valley is not visited by the foehn, while the portion below Martigny is visited with, often violent, foehn winds. The result is to make this part warmer and drier than it would otherwise be.

As a whole, however, the Valais is remarkable for the frequency of

calms, as compared for instance with our own windy climate. It is the frequency of calms which makes it possible to use places of relatively great elevation as health resorts, while, on the other hand, it makes it impossible for the foreigner at least to live with comfort on the floor of the Rhone valley in summer. This prevalence of calms is, however, only true of places situated in a valley. At the St. Bernard Hospice, for example, calms do not occur, and the wind blows either from the Swiss slope, *i.e.* from the north-east, or from the Italian slope, *i.e.* from the south-west, the former wind being the more frequent. Both winds come from warmer regions, and therefore both are moisture-carrying, hence the heavy precipitation.

The two important facts that emerge from this study of the Valaisian climate are, first, the unexpectedly high temperature over much of the area, and second, the unexpectedly low rainfall. Both are reflected in the vegetation. The high temperature leads to the growth of plants which are Mediterranean in character, the low rainfall limits the growth of moisture-loving plants like the deciduous trees. The steppe-like conditions produced by the strong insolation and low precipitation would be even more striking than they are were it not for that system of irrigation which is everywhere visible in the dry region above Martigny. Fortunately for the Valaisian, he has in his glacier-covered mountains a self-regulating mechanism which fills his water-courses the fuller the stronger the sun shines, and therefore the greater the need felt by his cherished plants. Let there be in summer a series of dull and cloudy days and the glacial torrents which feed his "bisses" dwindle to a mere shadow of their former selves.¹ Let the sun once more blaze forth in his splendour, and the torrents will pour a lavish flood into his watercourses, so that not only do alps and crops and vineyards receive all that they need, but a thousand streams trickling down the mountain sides proclaim the superabundance of lavish nature, while the climber whose task is lightened by the return of clear skies rejoices in the happy fortune which in the alps combines the interest of tourist and crops.

THE ZONES OF VEGETATION IN THE VALAIS.

In looking generally at the zones of vegetation in the Valais, and at their constituent plants so far as these have geographical significance, it is convenient first of all to discuss the limits of each. As the deciduous woods of the canton are insignificant, we need only recognise three regions:—(1) The region of cultivation; (2) the region of coniferous woods; and (3) the region of the high pastures or alps. Rion, as quoted by Christ, gives 1263 metres (or 4143 feet) as the mean upper limit of cultivation in the Valais. Imhof (see p. 191 footnote) shows that the coniferous woods have a mean elevation of 2150 metres (or 7054 feet), while according to Jegerlehner (*Beiträge zur Geophysik*, v. 1901-2) the mean height of the snowline, which virtually forms the upward limit

¹ For some actual figures as to the effect of a drop of temperature on the volume of the streams, see the paper by Erich Uetrecht, referred to on p. 171.

of the alps, is 3050 metres (or 10,000 feet). Something will be said below of the details of temperature in the region of the woods, but the following, quoted from Christ's *Pflanzenleben der Schweiz*, gives an interesting rough approximation. Christ says in effect that the zone of cultivation extends upwards so long as any two months have a mean temperature below zero, the coniferous woods so long as there are no more than *five* months in the year in which the mean temperature is less than zero, while in the alpine region there may be seven or more months with a mean of less than zero. On the diagram on p. 179 a line has been drawn through the zero reading to show that while Sierre with only one month with a mean temperature of below zero, is well within the zone of cultivation, and Zermatt with four months in which the mean is below zero, is well within the coniferous area, the St. Bernard with eight months in which the mean drops below zero, is above the tree-line and falls into the alpine area.

I.—THE REGION OF CULTIVATION.

In the region of cultivation, especially in the warm stretch between Martigny and Brig, the wild plants have a general Mediterranean aspect, and owing to the dryness the steppe character is pronounced. The warmth of the climate is shown by the presence of such cultivated plants as Indian corn and tobacco, despite the mean elevation. The chief plant of the lower part of the cultivated zone, that is, from about 460 to 800 metres (or 1500 to 2624 ft.), is however the vine, which is of great importance in the life of the inhabitants. It is grown wherever the slope of the valley walls is such as to permit of the needful terracing, and is found in the main valley from about Martigny to Mörel, especially on the northern side of the valley, and in the lateral valleys has a special extension up the valleys of the Dranse and the Visp. It is virtually absent from the valley between St. Maurice and Martigny for the climatic reasons already dwelt upon, and because of the shape of the valley. In the Dranse valley vineyards extend up to above 800 metres (2624 ft.) in the vicinity of Sembrancher, while their upward extension in the Visp valley is even more remarkable. Near Stalden the limit is about 834 metres (or 2736 ft.), but in 1878 Christ found vineyards at a height of 1020 metres (or 3346 ft.) in the vicinity of this village. The figures are only of interest because they serve once more to call attention to the peculiar climatic conditions prevailing here, upon which so much stress has already been laid. The station of Grächen (cf. p. 175) shows that the rainfall here is very low, and the proximity to the great mountain group, of which Monte Rosa is the centre, produces, as will be shown below, very favourable conditions of temperature.

Throughout the Valais the vineyards require artificial irrigation, and owing to the way in which most of the lateral torrents run at the bottom of deep gorges before they enter the main valley, the water has to be brought from great distances, the straight lines of the channels being visible for miles along the hillsides. The wine is of great importance as an article of diet on account of the monotony of the ordinary food

available—dry rye bread, baked once or twice a year only, hard cheese, and dried meat. In the article already alluded to (xxii. p. 648) something has been said of the appreciation in which it is held, and how certain kinds are stored in the mountain cellars and storehouses until they obtain the aroma which is so greatly prized. As is only natural under the circumstances, wine plays a large part in the social life of the people.

Above the zone where the vine forms the chief crop comes a region where rye predominates, this being the chief cereal of the region, and the one used to make the native bread. As has been said above, Rion gives 1263 metres (4143 ft.) as the line which marks the mean upward extension of cultivation, but in detail this varies greatly according to exposure. The typical instance is of course the corn-fields of Findelen,¹ near Zermatt, which extend up to 2100 metres (6890 ft.) on the sunny side of the valley, whilst the shady side is thickly clothed with Arolla pine, but almost every valley shows similar, if less striking conditions. Thus in the Val d'Anniviers we have fields near the village of Chandolin at a height of 1900 metres (6233 ft.). (Brunhes and Girardin.²)

Mingled with the rye of this upper zone are various other crops, grown on a smaller scale, while throughout the zone of cultivation are an abundance of fruit-trees, varying from the figs and peaches of the Rhone valley to the August-ripening cherries of the upper region. All the side valleys afford interesting studies of progressive change in the characters of the cultivated plants, and what has been already said as to temperature, etc., will make it clear that in the upper region, whatever the exposure, only fast-growing annuals can be grown with any prospect of success. Where, as frequently happens, the valley consists of a series of basins separated by relatively narrow steep defiles, the differences in the vegetation of the successive basins is very striking. The Val de Bagnes affords many very interesting examples of this kind. It may be sufficient to mention the contrast between Lourtier which, at a height of 1054 metres (3458 ft.), has many fruit-trees (cherries) and a considerable extent of cultivated ground, while at Fionnay at 1497 metres (4911 ft.) in the next basin, the fruit-trees have disappeared, and cultivation was represented in 1906, apart from the hay, by a tiny patch of wretched potatoes, and a handful of what the hotel proprietors optimistically regard as salad plants.

II.—THE WOODS OF THE VALAIS.³

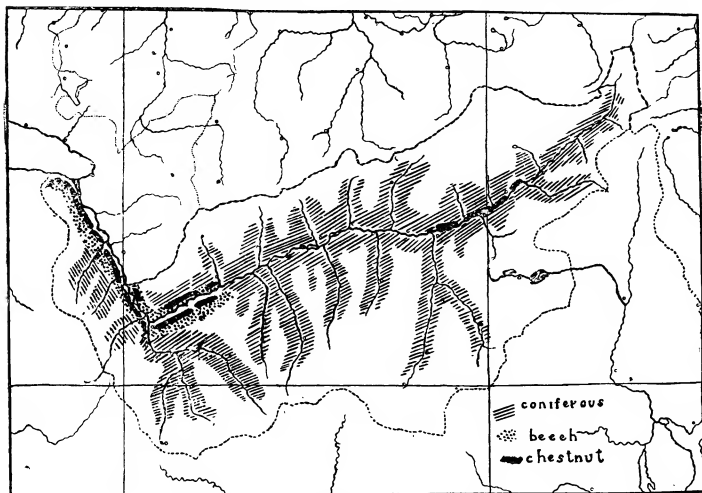
The Valais is relatively well-wooded. According to Uetricht (cf. footnote, p. 171), 15·9 per cent. of the total area of the upper basin of the Rhone is covered by forest. The four Highland counties of Ross and Cromarty, Sutherland, Inverness and Argyll, on the other hand, have only

¹ Cf. article by Prince Roland Bonaparte, *La Géographie*, xi. (1905), pp. 212-16.

² *Annales de Géographie*, xv. (1906), p. 347.

³ See especially Christ, *Das Pflanzenleben der Schweiz*; Zurich, 1882. *Die Zirbe*, G. G. Simony, *Jahrbuch d. oesterreichischen Alpen-Vereines*, vi. (1870), and *Lebensgeschichte d. Blütenpflanzen Mitteleuropas*, von Kirchner, Loew u. Schröter; Stuttgart, 1904-5.

3·4 per cent. of woods. In view of the emphasis which has been already laid on the mountainous nature of the Valais, it is hardly necessary to state that the woods are predominantly coniferous in type. Of the wood-forming deciduous trees of Switzerland, the beech, as the accompanying map shows, occupies a relatively small part of the canton. As mentioned above, it practically occurs only in the lower part of the Rhone valley, where the necessary conditions of moisture obtain. Accompanying the beech in the lower part of the Rhone valley, and also in parts of the lateral valleys, such non-forest-forming deciduous trees as elm, maple, linden, etc., occur. Very striking to those accustomed to the Scottish Highlands is the virtual absence of the birch. Like the Scotch fir, the



The Woods of the Valais (modified from Christ).

birch is not totally absent, but like the latter also it suffers severely from competition with other species, more tolerant of shade. It is the absence of competitors which largely determines the predominance of both species in the Highlands.

Another deciduous tree which forms woods of some extent in parts of the Valais is the chestnut, whose distribution is also illustrated in the map. As Christ points out, the character of the trees and of their fruit, as compared with the trees and fruit of Italian specimens, shows that the conditions in the Valais are not altogether favourable to the species, and its range is limited.

Very different from the small area occupied by deciduous woods is that covered by the dominant conifers. A considerable number of indigenous conifers occur in Switzerland, but those which are most important as forest-formers in the Valais are three in number. First and by far

the most important is the spruce fir (*Picea excelsa*, Lk.); mingled with this, especially near its upward limit, is the larch (*Larix europaea*, D.C.); while above larch and spruce, especially on the flanks of the great Monte Rosa group, grows the beautiful and interesting Arolla pine, the *Arve* or *Zirbe* of the Germans (*Pinus cembra*, L.), which sometimes, as in the Zermatt valley, forms extensive woods.

The Spruce.—Of these three trees the spruce, as every one knows, is widely distributed in Europe. Absent as an indigenous tree in Italy, Spain, and in Southern Europe generally, in the greater part of France, in Great Britain, Belgium, the Netherlands, Denmark, and part of the North German plain, it forms elsewhere one of the most important of the European forest trees, and is so abundant in Scandinavia as to receive the common name of Norway spruce. It is, however, also the most characteristic tree of the true Alps, its place on the lower ground of the Jura being largely taken by the silver fir. It is the "pine" of most popular descriptions of the Alps, and its heavy foliage and pendent cones may be recognised in most views of Alpine scenes.

Its distribution over Europe is partly, but not wholly, determined by climate; not wholly, for it is absent, for example, from Great Britain, although the climate of the west of Scotland is well suited to its needs, and in many parts of Britain it flourishes exceedingly when planted. In general, however, its distribution may be said to be determined by the fact that it is intolerant of great heat, though resistant to cold, and that it demands a considerable amount of moisture during the growing season. According to Purkyne, it must have a mean July temperature of at least $+10^{\circ}\text{C}$., but not exceeding 18.7°C ., and the mean January must not fall below -12.5°C . According to Kerner, the annual isotherm of 1.6°C . marks its upward limit. In parts of Switzerland, however, according to Schröter and Kirchner, it grows where the mean annual temperature falls much below 1.6°C . It is in consequence of these necessary conditions of temperature that it is a mountain tree in those parts of Central Europe in which it occurs, and a plain-dweller in the northern parts of its range. But in Central Europe generally its extension downwards from the mountains towards the low ground is limited not wholly by climate, but in part by the fact that it there comes into competition with the more highly evolved deciduous trees. Its extension *up* the slopes is, on the other hand, chiefly determined by the meteorological conditions. According to Jaccard, it ascends in the Valais to a mean height of 2000 metres (6562 ft.), with a maximum height of 2210 metres (7251 ft.). But in the Valais, according to Imhof,¹ the mean height to which woods ascend is 2150 metres (7054 ft.), with a maximum of about 2300 metres (7546 ft.). It is thus obvious that in some cases the spruce must itself form the tree limit, and at worst it leaves but a narrow band unoccupied which may be taken advantage of by the larch and Arolla pine.

Its upward extension is limited by the temperature range already mentioned, and the tree further requires, as already stated, a moist

¹ *Die Waldgrenze in der Schweiz*, von E. Imhof. *Beiträge zur Geophysik*, iv. (1899-90), p. 241.

atmosphere. Because of its needs in regard to warmth and moisture, we find in the Swiss Alps that all exposures are not equally favourable. Thus it rises higher on a slope facing south-west or south than on one facing north-east or north. As its wide horizontal range indicates, it is tolerant of very varied types of soil, but will not thrive on very poor or dry ground. As regards life-history, it is sufficient to quote from Schröter and Kirchner's monograph some facts about the rate of growth.

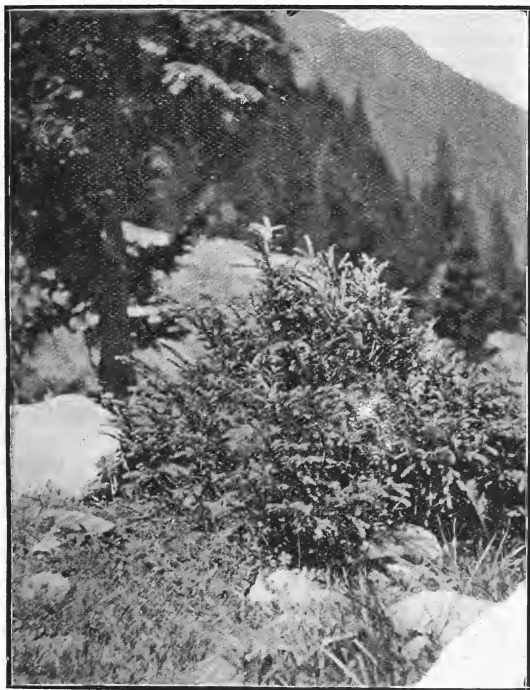


View near Fionnay, Val de Bagnes. The woods are spruce, mingled with larch ; alder in foreground by the stream.

For the first ten years of existence this is slow, the average height at the end of the period being only $1\frac{1}{4}$ - $1\frac{1}{2}$ metres (4-5 ft.). From the tenth year the rate of growth increases until it attains a maximum at forty to fifty years, the average height at forty being 9 metres ($29\frac{1}{2}$ ft.). After the fiftieth year the rate of growth gradually declines. Seed production commences when the tree is between thirty and forty years old, and seeds are not abundantly produced until it is about fifty. As a general rule a rich harvest of seed only appears once in three years. As will be shown later, though the rate of growth appears slow and the

power of reproduction late in appearing, yet the Arolla pine contrasts unfavourably with the spruce in these respects.

The spruce appears in a considerable number of forms, according to the special conditions of life. One of these is specially interesting because of its frequency. In the Alps, especially near grazing grounds, it is very common to see spruces like that shown in the accompanying photograph. In these forms there is no leader, a very short leader, or



Spruce, with the leader destroyed by goats; profuse branching has occurred below.

several small leaders. The tree has a bush-shape, and displays a number of branches, almost prostrate on the ground, and some rooting in the ground. These forms, which may be of considerable age in spite of their small size, are produced as a result of injury by grazing animals. These bite off the leader in the young tree. As a result copious lateral branching takes place, the lateral branches lying close to the ground. After a time these lateral branches form a hedge round the centre, which is thus efficiently protected from further injury. One or more branches then take on the function of leader, and shoots up suddenly, with the

result that the ordinary form is more or less perfectly re-acquired. Other forms may be produced by constant injury from snow or avalanches. The spruce, in spite of the downward droop of its branches, must, on account of its heavy foliage, be very liable to injury from snow, and it is often interesting in a fir-clad valley to notice that those parts which from the shape of the cliffs above must be avalanche-swept in winter are bare of trees, while the neighbouring parts are luxuriantly clothed.

*The Larch.*¹—As compared with the spruce the larch differs not only in appearance, but also in many other respects. While the spruce has a wide distribution, the larch of Europe has a very limited one. It is in essence an inhabitant of the Alps and the Carpathians, and is indigenous only in a narrow band of mountainous country, stretching from the Dauphiny in the west to the vicinity of Kronstadt in Transylvania in the east. Like not a few other conifers, it had formerly a more extensive distribution, and even in the area to which it is native it is suffering from the competition of the dominant spruce. In the Dauphiny, where the spruce reaches its limit, in the Monte Rosa district, and in the Engadine, the larch forms extensive woods, but elsewhere it largely occurs in the form of specimens scattered through the spruce woods. In the Dauphiny it ascends to its maximum height of 2500 metres, and in the Zermatt valley trees, as distinct from woods, occur up to the 2400 metre (7874 ft.) line. In view of these facts of distribution two questions arise—why can the larch not compete with the spruce on the lower slopes? and how is it that it replaces the spruce in the upper region, as for example at Zermatt? It is in the necessary conditions of existence of larch and spruce that the answer is found to both questions.

First, as regards temperature:—the larch can grow where the mean annual temperature is only -1° C. so that it is more resistant to cold than the spruce. On the other hand, it cannot thrive if the mean annual temperature exceeds 10° C. As it sheds its leaves in winter, severe cold does not greatly affect it, and it appears to demand a winter's rest of at least four months. On the other hand, as the needles are more delicate in structure than those of the spruce, they are very liable to be injured by a cold spring. The larch, in short, is fitted for a continental climate, a cold winter, and a sudden hot summer, with but little intervening spring. The high ground suits it best, for there it is not tempted to put forward its leaves until winter has finally taken its departure. It requires less moisture than the spruce, for its root system is better developed, and it thus obtains water from a larger area. Again, the shape of the tree and the deciduous leaves minimise the risk of injury from snow, which cannot lie on the slender branches. The combination of the above peculiarities make it easy to understand why the larch can grow at elevations which are impossible for the spruce. Why is it that the lower ground is less suited to it, and that here the spruce gains the mastery? One important point is that the larch must have a large amount of light at all stages of growth. The young

¹ See *Lebensgeschichte d. Blütenpflanzen Mitteleuropas*, von Kirchner, Loew u. Schröter.

spruce is tolerant of shade, but the larch at all stages of growth must have full exposure to sunlight. One consequence of this is that in a larch wood the trees stand well apart, while in a spruce wood they stand close together. If we suppose that in such a wood a few spruces are introduced, then it will be found that the shade which prevents the larch seedlings from growing does no harm to the spruce seedlings, and thus if the other conditions are favourable to the spruce it will more and more predominate, and more and more produce a degree of shade throughout the wood which will absolutely prevent the natural reproduction of the larch. The handicap in favour of the spruce is, however, somewhat diminished by the fact that the larch grows much faster. In the ten years which it takes the spruce to grow about a metre and a half (4.9 ft.) the larch seedling has grown about $4\frac{1}{2}$ metres ($14\frac{1}{2}$ ft.) that is in youth it grows three times as fast. Though the rate of growth diminishes in later life, yet at forty the larch can show a height of nearly 20 metres ($65\frac{1}{2}$ ft.) as against the 9 metres ($29\frac{1}{2}$ ft.) of the spruce.

The result is that where the meteorological conditions are quite unsuited to the spruce the larch in the Valais forms pure woods—why this is specially true of the Valais and Engadine we shall see later. Where the conditions favour the spruce we shall find woods composed for the most part of that species, but with an admixture of larch wherever local conditions handicap the dominant species. Thus, if a particular spot is much exposed to snowdrifts, the larch will thrive better than the spruce because of its shape. If the place is storm-swept, the better root development of the larch is in its favour. So with dryness of the soil, which checks the growth of the spruces and allows the larches to take advantage of their quicker growth to get beyond the upas-like influence of their neighbours. This being the case, it is easy to understand that the fact that the larch is usually found at considerable elevations is not wholly due to its preference for these heights, but is in part the result of the difficulty which it has in competing with the spruce on the lower ground. Such facts as that it occurs at a height of 423 metres (1387 ft.) at Martigny show that its infrequency at low levels in the Valais is not altogether to be ascribed to its special peculiarities, but is in fact a result of the Struggle for Existence. On the other hand, the fact that it does not occur till a height of 1100 metres (3609 ft.) at Sion is probably due to a climatic cause; cf. what has been said above as to the climate of this region.

(To be continued.)

THE RIVERS OF SCOTLAND: THE BEAULY AND CONON.

By LIONEL W. HINXMAN, B.A., F.R.S.E.

(With Map and Diagrams.)

UNLIKE the Spey and other large streams of the north-east coast south of the Moray Firth—rivers of simple type in which the tributaries are throughout distinctly subordinate to the main stream—the Beauly and the Conon are examples of a complex river system, formed of several large streams nearly equal in length and volume, and confluent at a comparatively short distance above the river mouth.

This character is most marked in the case of the Beauly, and is indeed apparent in the nomenclature of the river system. The Affric, the Cannich, and the Farrar, streams of almost equal volume, unite to form the river Glass, which at some indeterminate point in its course between Struy and Eilean Aigas ceases to bear that name and flows to the sea as the Beauly River.¹

The apparent redundancy in the name Glen Strath Farrar now given to the valley of the Farrar, may possibly be accounted for when we remember that the Beauly Firth was the *Æstuarium Vararum* of the early geographers, the estuary of the Varar—that name being evidently applied to the whole of the Farrar-Beauly river. The lower and wider portion of the valley would then be the Strath—the upper section, above Struy, the Glen—of the Farrar. When in later times the name Farrar ceased to be given to the river below Struy, and that portion of the valley became merged in Strath Glass, the name Glen Strath Farrar remained to indicate the “glen” portion of the vanished Strath Farrar.

THE BEAULY.

The Beauly river system falls naturally into four well-defined sections.

1. The mountain valley section. This includes the torrent heads, the lake basins, and the lower courses of the Affric, the Cannich, and the Farrar. The last two of these flow in a direction transverse to the general “graining” of the country, while the trend of the Affric is transverse-oblique.

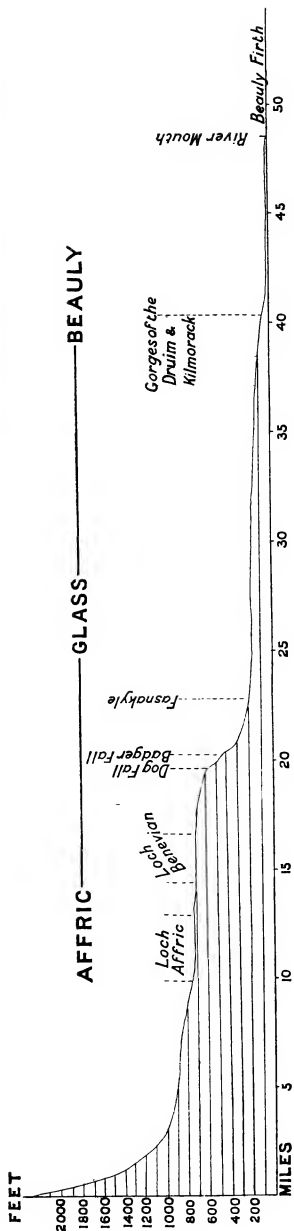
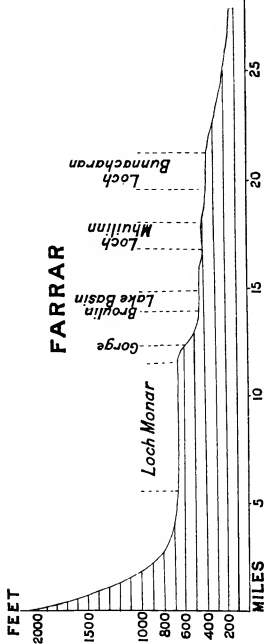
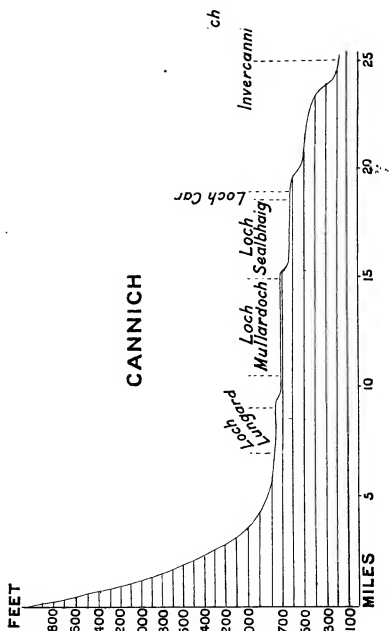
2. The flat valley track, represented by the course of the river Glass, longitudinal between Fasnakyle and Erchless, and transverse from Erchless to Eilean Aigas.

3. The gorges of Eilean Aigas, the Druim, and Kilmorack.

4. The lower course of the Beauly, between the foot of the gorges and the sea.

It is unnecessary to trace in detail the courses of each of these streams, as they can be followed on the map. Some figures, however, may be

¹ The whole stream below the mouth of the Farrar is often called the river Beauly; but, on the other hand, Strath Glass is generally considered to extend to the head of the gorge at Eilean Aigas.



useful in order to give an idea of the relative proportions of the different sections of the river system. The area of the entire basin is approximately 407 square miles, the greater part of which is high mountain ground. The watershed lies within a few miles of the western seaboard, the sources of the Affric, Cannich, and Farrar being distant respectively 5, $7\frac{1}{4}$, and $7\frac{1}{2}$ miles from the salt water of Lochs Duich and Carron. The lengths of the component streams, measured along the principal windings, and including the lochs through which they pass, are as follows. The Affric to Fasnakyle, 21 miles; the Cannich, 24 miles; the Farrar, 28 miles; the Glass from Fasnakyle to Eilean Aigas, 16 miles; the Beaully from Eilean Aigas to Tarradale, $10\frac{1}{2}$ miles. The total length of the Affric-Glass-Beaully is therefore $47\frac{1}{2}$ miles, of the Cannich-Glass-Beaully 48, and of the Farrar-Glass-Beaully $44\frac{1}{2}$ miles.

Section 1.—Resembling one another in the physiographical character of their basins, and in the causes which have controlled the evolution of their valleys, the Affric, Cannich, and Farrar differ only in the extent to which each has graded its course. They are essentially immature rivers; that is to say the fall from source to mouth is unequally distributed over their course, so that the profiles, shown in the accompanying diagram, depart largely from the smooth curve of a perfectly graded stream.

Each of these rivers presents a succession of lake basins, or stretches in which the local base-level of erosion has been approximately reached, succeeded by rock barriers which usually correspond to constrictions of the valley, and are in most cases due to hard and less easily eroded bands of rock.

The grading process has reached the furthest stage in the Farrar. The rock barriers along the course of that river have been to a considerable extent cut through, so that gorges and rapids, rather than waterfalls, mark the successive steps in the fall of the valley. A further effect of this partial lowering of the barriers is seen in the draining of former lakes, such as that represented by the wide alluvial flat below Broulin Lodge; and the lowering of the waters of the existing lochs indicated by the terraces which surround Loch Mhuilinn and Loch Bunacharan, and mark the former level of their waters. In Glen Cannich we find an earlier stage of valley grading. Here the chain of lochs is strung so closely on the river thread that of the 18 miles of its course—neglecting the torrent head—nearly 8 miles are through lochs, and the connecting links of river, between Loch Lungard and Loch na Cloiche, Loch Mullardoch and Loch Sealbhag, only a few hundred yards in length. The erosion of the successive rock barriers is less advanced than on the Farrar, and the waters of almost all the higher lochs escape either over a fall or down a steep rapid little less than a fall. Only in the lower part of the glen has the river cut back sufficiently to produce a gorge such as that below Loch Craskie, and lower to some extent the waters of the loch above. The higher lochs show no signs of shrinkage, but terraces marking a slightly higher level are found round Lochs Sealbhag, Car, and Craskie.

The profile of the Affric is of a still simpler character. The

total fall of the river to Fasnakyle is 2530 feet, of which 1850 feet takes place along the five-mile course of the mountain torrent above Alltbeath. The remaining fall of 680 feet is very unequally distributed over a course of 19 miles. Nine miles of this distance, from the head of the silted-up portion of Loch Affric to Achagate below Loch Beinn a' Mheadhoin, is practically a lake basin, with a fall only of 40 feet in the short length of stream above Loch na Laghan; and of the remaining 480 feet the river drops 310 feet in the $1\frac{1}{2}$ miles which include the Dog Falls, the Badger Falls, and the connecting rapids. This sudden drop in level is represented on the profile diagrams by the steepening of the curve between the 20th and 25th mile, a feature which is most strongly marked on the Affric, less so on the Cannich, and is comparatively smoothed on the Farrar. This sudden steepening of the gradient corresponds more or less closely in each valley with the outcrop of a belt of gneissose rocks, much folded and resting at high angles. It may, therefore, be due to the superior resisting power of these rocks compared with those at the mouth of the valleys, while it is possible that the latter may have been more or less shattered by a line of fracture which passes along Strath Glass, and thus rendered more subject to erosion.

An over-deepening of the upper part of Strath Glass with regard to the tributary valleys might also be suggested as a cause of the sudden drop at the foot of Glen Affric, which might thus be regarded as a hanging valley. It is, however, difficult to suppose that a volume of ice passed into the head of Strath Glass larger than that which must have descended from the wide extent of lofty mountain ground that surrounds the upper portions of Glen Affric and Glen Cannich.

Before passing to the next section, some interesting points in the earlier history of the Farrar may be referred to.

Of the two streams which fall into the head of Loch Monar, the Amhainn an-t-Sratha Mhoir or Strathmore river has now the greater volume, and may be regarded as the real head of the river Farrar. The other, the Allt Loch Calavie, flows for the greater part of its course through a chain of lochs lying in a wide level valley, which heads up to the main watershed of the country at a point where it is only 865 feet above sea-level. The low drift-covered col rises but a few feet above the stream on the western side of the watershed, a tributary of the river Ling, and the flat marshy valley of the Allt an Loinfhiodha as far down as the foot of Loch Cruoshie is clearly a continuation of the hollow by which the eastern drainage now passes through the Gead Lochs into Loch Monar. The stream below Loch Cruoshie is rapidly eroding its present steep gorge, and it is evident that since glacial times it has cut back eastwards sufficiently to rob the headwaters of the Farrar of the volume represented by the three burns which now flow into Loch Cruoshie.

The gorge of the Garbh Uisge below Monar Lodge is a recent post-glacial portion of the river channel. Its earlier course, occupied at a time when the valley south of Beinn na Muice was probably blocked with ice, lay through the hollow between Loch Bad na h'Achlaise and the

Uisge Misgeach. Other higher channels occupied by the river during former stages of the grading of its course can be detected immediately above Ardchuilk, at the level of the road between Lochs Mhuilinn and Bunacharan, and again at the roadside half a mile below Deannie Lodge.

The bathymetry of Loch Monar and of most of the other lochs mentioned in this paper has been fully discussed in the Reports of the Scottish Lake Survey published from time to time in the pages of this Magazine.¹ It will therefore be sufficient to say that all or nearly all these lochs occupy rock-basins, though, in some instances, their waters are partially held up by drift or alluvial deposits. Ice has in every case been the principal eroding agent, and the powerful fault which crosses Loch Monar in an oblique direction has probably played an important part, as a line of weakness, in the evolution of that loch. The smaller lochs are all of comparatively recent origin, and may be regarded as only transient features, that under present conditions are being slowly obliterated by the grading of the river valleys.

Section 2.—Between Fasnakyle and Erchless the river Glass occupies a straight, trench-like, longitudinal valley, whose trend has been determined by a line of fault. The fall of the valley floor from Invercannich to Struy, a distance of $6\frac{1}{2}$ miles, is only 15 feet; the stream has graded its course, and now winds in sluggish curves, with here and there an "ox-bow" lake representing a former "cut-off," through a deep deposit of silt, sand, and fine gravel.

There is little doubt that this portion of the valley is a waste-filled basin, at one time occupied by a narrow glen-lake comparable on a small scale with Loch Ness, and like it, developed along a NNE-SSW. line of fracture and consequent weakness. The waters of this lake probably extended to the head of the gorge at Eilean Aigas and were gradually drained by the erosion of the rock barrier below, while the higher reaches were being silted up with the material brought down by the mountain streams.

At Eilean Aigas the character of the river completely changes. The wide haughlands and sweeping curves of the Glass give place to the picturesque gorges through which the Beaully rushes in alternating fall and rapid amid the beautiful scenery of the Druum and Kilmorack. These gorges have been cut deep into the Old Red Sandstone conglomerate, and in places even reach the underlying floor of metamorphic rock.

A feature common to most of the rivers that fall into the Moray Firth is the abnormal steepening of the lower part of their course, generally at or near the point where they breach the inner or landward margin of the Old Red Sandstone belt.

In a former paper on the Spey² I have attributed this phenomenon, which is particularly well marked in the case of that river, to the rejuvenation produced by an uplift later than the deposition of the Old Red Sandstone. In the case of the Beaully it seems probable that the more recent uplift which raised the shore-line 100 feet above its present

¹ Vol. xxii. No. 9, 1906; vol. xxi., 1905.

² "The River Spey," *Scottish Geographical Magazine*, April 1901.

level was an important factor in the production of the lower gorges. The 100-foot beach, which forms a conspicuous feature along the shores of the Beaully Firth, can be traced to the mouth of the Kilmorack gorge, while the 100-foot contour-line crosses the river at Teanassie, more than a mile higher up. It is evident that erosion must have been largely accelerated on the down-stream side of the uplift by the steepening of the gradient.

At the mouth of the Kilmorack gorge the Beaully enters the final section of its course, and flows gently over a wide alluvial plain to the sea. Above the village of Beaully the river is eroding the marine deposits of the successive raised beaches, while below it pushes out into the head of the Beaully Firth an ever-advancing delta of silt and mud, closely similar to the estuarine shelly clays that extend far up the valley of the Conon to the limit of the 100-foot beach.

The course of the Beaully between Eilean Aigas and the sea is entirely postglacial. An earlier preglacial channel is indicated by the hollow of Lonbuie, which runs from Eskadale through Fanellan to Beaufort Castle. The higher part of this hollow is now deeply filled with boulder clay, the lower portion with alluvial sand and gravel. From Beaufort the river probably flowed through the low-lying tract of ground occupied by the now drained Moniak Moss to the sea between Clunes and Lentrane.¹

Having thus discussed in more or less detail the courses of the streams that form the present Beaully river system, it remains to consider briefly the earlier history of its development.

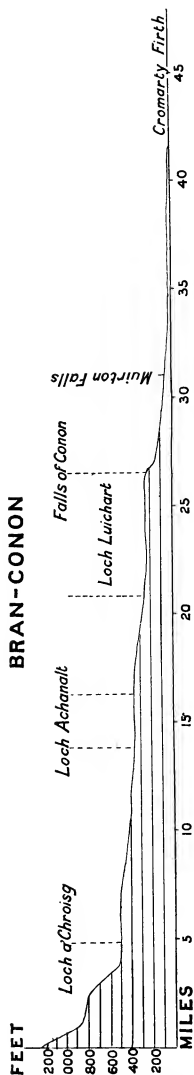
It seems probable that the Farrar, Cannich, and Affric represent the headwaters of a consequent easterly-flowing river system developed on the original surface of the Old Red Sandstone plateau, which we know from the outlying fragments of that formation found far up the inland valleys, must at one time have covered the eastern side of the watershed up to a height of at least 2500 feet above present sea-level.

A study of the map shows the significant manner in which the wide valley of Glen Urquhart and Corrimony heads up to a well-marked depression in the eastern wall of Strath Glass, directly opposite to the mouth of Glen Cannich, and continues the line of that glen eastwards to Loch Ness. It is therefore not unreasonable to suppose that Glen Urquhart once formed part of the course of a large eastward-flowing river, whose head-waters were captured by a longitudinal stream at the time when the removal of the Old Red Sandstone covering by denudation brought into play the features of an earlier drainage system, and diverted the confluent waters of the Cannich and the Affric into the pre-Old-Red-Sandstone valley of Strath Glass.

The Farrar-Glass-Beaully still preserves more or less its easterly course, but the lower part of the valley has been largely modified by subsequent events, and in earlier times the river probably flowed over a plain of Old Red Sandstone that occupied the position of the Beaully Firth, discharging its waters into the Moray Firth far to the eastward of the present shores of the Black Isle.

¹ As suggested by Mr. Wallace in his article "Geological Changes in the Moray Firth." *Trans. Inverness Scientific Soc.*, vol. ii. p. 384.

THE CONON.



The upper part of the Conon river system is composed of the Meig and the stream which flows through Loch Luichart. The name Conon is first given to the river where it issues from that loch, the stream that flows into the head of the loch being known as the Bran. It is, however, significant that the Meig valley, which continues the line of the valley of the Conon below their junction, bears the name of Strathconon, and it would seem more fitting that the name Bran should be extended to the confluence of the Loch Luichart stream with the Meig, the name Conon being restricted to the united waters below that point. A Gaelic verse, quoted by Mr. Watson in his excellent work on the place-names of Ross and Cromarty, has reference to this anomaly:—

“Abhainn Mig tre Srath-chonuinn,
Abhainn Conuinn tre Srath-bhrainn,
Abhainn Dubh-chuileagach tre Srath-ghairbh;
Tri abnaichean gun tairbh iad sin.”

“The River Meig through Strath Conon,
The River Conon through Strathbran,
The River of black nooks through Strathgarve;
Three rivers without profit these.”

At Contin (the confluence) the river is joined by its most important tributary, the Blackwater, and four miles above its mouth receives on the right bank the waters of the Orrin. The area of the Conon drainage basin approximates to 483 square miles. The lengths of the various sections are as follows: the Meig, $24\frac{1}{2}$ miles; the Bran, to the foot of the Meig, $26\frac{1}{2}$ miles; the Bran-Conon, $38\frac{1}{2}$ miles; and the Meig-Conon, $36\frac{1}{2}$ miles. The principal tributaries of the lower river, the Blackwater and Orrin, measure respectively 28 and 23 miles in length.

The mountain torrent which forms the headwaters of the Bran-Conon rises at a height of 1500 feet on the slopes of Carn Breac, at a point only 9 miles distant from the salt water of Loch Torridon, and falls 1000 feet in its course of 5 miles to the head of Loch a' Chroisg (Rosque). Issuing from the loch as the river Bran, the stream is cutting through the high-level terraces of sand and gravel which are seen on either side of the railway a short distance to the west of Achnasheen station. These represent, as pointed out by Dr. Penck of Vienna,

and further described by Dr. B. N. Peach, delta deposits laid down in an ancient lake, which was held up by masses of ice lying in the valley to the east and south of the present junction of the Bran with the stream flowing out of Loch Gown.

From Achnasheen the river winds eastwards with a gentle fall through the grassy alluvial stretches of Strathbran, its straighter course immediately above Dosmuckeran indicating a steeper gradient where the stream leaves the floodplain and has cut a shallow gorge through the flagstones at the foot of Druim Dubh. Below Dosmuckeran the river meanders in sluggish curves between high banks of sand and clay through a flat stretch of meadow land. This alluvial flat is the silted-up head of a large loch, now represented only by the shallow reedy waters of Loch Achanalt and Loch Cuilinn. In addition to the filling up of this earlier lake by the stream at its head, its waters were lowered by the cutting back of the rock barrier below Loch Cuilinn, and the latter loch separated from Loch Achanalt, the former connection of the two lakes being plainly indicated by the continuous terraces that can be traced around them both. After leaving Loch Cuilinn the Bran passes in rapids and small waterfalls over a series of rock barriers, above each of which the stream expands into a wide reach of comparatively still water, and falls 110 feet to Loch Luichart in a distance a little less than two miles. A mile above that loch it is joined by the Grudie river, which drains Loch Fannich and the southern slopes of the Fannich mountains. This is a rapid rocky stream, and falls 460 feet in the last $3\frac{1}{2}$ miles of its short course from the loch. The bathymetry of Loch Luichart presents some interesting features, which are fully discussed in the Report of the Scottish Lake Survey on the lakes of the Conon basin.¹ It may, however, be pointed out that the abnormal depth found close to the head of the loch is probably due in great measure to the powerful wrench-fault which here crosses the lake. The effect of this line of movement would be to shatter and disintegrate the rock and thus increase the erosive effect of the moving ice at this point.

The most prominent feature in the profile of the Bran-Conon, below Loch a' Chroisg, is the sudden drop below Loch Luichart, where, in a distance of just under a mile, the river falls 130 feet between the rock-lip of the loch at the Falls of Conon and the mouth of the gorge at Little Scatwell. It is noticeable that the Falls of Conon occupy an almost exactly similar position with regard to the loch above and gorge below as do the Rogie Falls on the Blackwater river, referred to in the sequel. The erosion of the Loch Luichart barrier has, however, not yet been sufficient to lower appreciably the waters of the loch above and produce a marginal terrace as is the case with Loch Garve.

The course of the Meig is less varied than that of its sister stream the Bran. Rising at a height of 1200 feet at the head of Gleann Fhiodhaig, it runs with a fairly even fall of 730 feet in 9 miles to Scardroy at the head of Loch Beannachan. Here a partially eroded barrier of Lewisian gneiss crosses the stream and forms a waterfall,

¹ "Lochs of the Conon Basin," *Scottish Geographical Magazine*, vol. xxi. p. 467, 1905.

while openings in the barrier at higher levels with corresponding terraces mark former courses of the stream.

The waters of Loch Beannachan lie in a hollow due to erosion along a line of fault that can be traced westwards to Loch Maree.

The Meig issues from Loch Beannachan through a deep accumulation of fluvio-glacial sand and gravel, which to some extent holds up the waters of the loch; and rock is first met with in the bed of the stream a mile below the outlet. Between Inbhiorainn and Milltown of Strathconon the river runs NNE. and nearly at right angles to its higher course through a straight cañon-like valley, whose lofty and precipitous eastern wall of shattered and reddened rock forms one of the most striking features in the scenery of Strathconon. This valley has been determined by a powerful line of dislocation which can be traced for a great distance through the counties of Ross and western Inverness, with a trend parallel to that of the faults which have determined the Great Glen and the upper part of Strath Glass. This Strathconon fault has already been mentioned as crossing the head of Loch Luichart. At Milltown the Meig leaves the fault-valley and resumes its normal easterly course with a fairly even fall through Strathconon. For a distance of half a mile above Little Scatwell the gradient is less matured, and the stream struggles in a deep and narrow gorge through the siliceous flagstones of Torr a Bhealach.

Issuing from their respective gorges at Little Scatwell, the Meig and Bran enter a wide flood-plain, through which their waters, united in the Conon river, flow to a point below Comrie where the valley is again constricted, and a band of siliceous rock crossing the stream has produced a low waterfall and rock gorge below.

The next steep drop in the gradient is found at the Muirton Falls just above Newton, where the Conon encounters the coarse breccia of Old Red Sandstone age which forms Torr Achilty. The fall or steep rapid caused by the outcrop of this hard conglomerate is succeeded by a stretch of a mile in which the river flows swiftly over a floor of gently inclined grey shales and flagstones. These rocks are on the same horizon as the beds from which are derived the mineral waters of Strathpeffer, and several sulphureous springs rise from the river bed near Clachuile Inn, but are only exposed when the water is at a low summer level.

The insignificance of the Muirton gorge as compared with that cut by the Beaully river through the Old Red Sandstone at Kilmorack is remarkable, but may be explained by the fact that a fault here crosses the river, bringing the shales and flagstones into contact with the lowest portion of the basal conglomerate. The Conon has therefore had an easier task in eroding its channel through these softer rocks than the Beaully on its three-mile course through the hard conglomerates of Kilmorack and the Druim.

It may be pointed out that here again the limit of the 100-foot raised beach coincides very nearly with the head of the gorge at Torr Achilty. Near Muirton Mains finely laminated blue shelly clays of estuarine character are found up to the 100-foot level, and upon these

appear to rest the moraines that mark the last retreat of the valley glacier up Strathconon.

From Torr Achilty to the sea the Conon flows through a wide alluvial plain, eroding the marine deposits of the raised beaches, and at the same time laying down its own load of material. At Moy Bridge it receives the waters of the Blackwater, and a short digression must now be made to describe the salient points in the course of this important tributary.

There are many points in similarity between the physiography of the Blackwater and that of the Conon, and these have been determined by closely similar causes. The three large streams which form the headwaters of the river under consideration—the Glascarnoch and the streams which flow through Strath Vaich and Strath Rannoch—each present in some part of its course the usual alternation of lake or drained and silted-up lake-basin with rock gorge through which the stream is eroding the determining barrier below.

Two mountain torrents, draining the southern slopes of Beinn Dearg and the northern corries of the Fannich range, unite a short distance east of the low flat watershed to form the Glascarnoch river. It is, however, evident that the waters of Loch Droma and the Allt a' Mhadaidh, which now flow westwards to Loch Broom, have been stolen from the Blackwater basin by the river Broom, which has cut back more rapidly than the gently graded upper portion of the Glascarnoch stream. The flat alluvial stretch, some four miles in length, above Aultguish Inn is evidently the bed of a glen lake filled up with the detritus brought down by the hill streams, and drained by the erosion of a barrier mainly formed by the belt of foliated granite which crosses the valley above Inchbae.

Below Strath Vaich the valley gradient steepens, and the river falls 430 feet in seven miles to Gortin, at the head of the alluvial flat which represents the silted-up head of Loch Garve. This loch has also been drained to a considerable extent by the lowering of the rock barrier at the Falls of Rogie, and the conspicuous terraces round the southern part of the loch show the former extent of its waters.

A high terrace of sand and gravel extends from the mouth of the rock gorge eroded by the river below the Rogie Falls to the entrance of the hollow occupied by Loch Achilty, whose waters are to a large extent held up by deep alluvial deposits. There are indications that at an earlier period, when the lower part of the valley was possibly blocked with ice, the water may have passed through this hollow, which connects the valleys of the Blackwater and the Conon.

Two miles below the confluence of these rivers the waters of the Orrin pour in from the south, over a delta of coarse alluvial deposits, through channels that shift with every heavy flood. The course of the Orrin through its wild mountain valley presents no features of special interest. The fall of the stream, 1200 feet, is fairly evenly distributed over its course of 23 miles, but is on the whole greater in the portion below Camban. Loch na Caoidhe, at the head of the valley, occupies a rock basin, and the graded stretch that extends for a mile and a half

below Am Fiar Loch represents the former extent of that piece of water. The Orrin Falls are due to the outcrop of a band of conglomerate, greater in resisting power than the softer shales and flagstones below.

Like the Beaully, the Conon was at an early period of its history developed on the eastward slope of a plateau of Old Red Sandstone and, possibly, Secondary rocks, but does not appear to have been modified to the same extent by the reassertion of earlier surface features, and still preserves to a large extent its original consequent course. It is possible, however, that the southward bend of the Blackwater between Garbad and Garve was determined by the high ground of An Cabar and Little Wyvis, and that the pass between those mountains indicates an earlier eastward line of drainage.

The lower course of the Conon, like that of the Beaully, was continued over the Old Red Sandstone plain far to the eastwards of its present mouth, and, as has been suggested by Mr. Hugh Miller,¹ the opening between the Sutors of Cromarty may have been eroded by the river as it cut its way down through the softer strata by which the gneiss of the Sutors was deeply covered.

THE BLACK MAN'S MIND.²

THESE two volumes are clear testimony that the importance of West Africa to the student of ethnology is being recognised. Ultimately both deal with the same subject. They are earnest attempts to discover the first principles of the religion of the West African native. Major Leonard, in a large volume of 560 pages, has given us the result of over ten years' study of the tribes in Southern Nigeria, and Mr. Dennett has been reaching forward to the conclusions he arrives at, during a stay of nearly thirty years on "the Coast." Both volumes are intensely interesting, and what has to be said regarding their form had best be said first. The illustrations in Mr. Dennett's book are on the whole well done, and the signs given on p. 71 open up a subject that requires thorough investigation—that of the sign-writing used by the natives. Unfortunately Mr. Dennett overloads his pages with native terms that are very difficult to remember, and to read his book involves the retention in the mind of a goodly number of Bavili and Bini words. It is well that the proof-reading is nearly perfect and the index very full, though there are one or two omissions. On page 65 we have *Mvumvuvu*, and this is the form found in the index which contains no reference to pages 107-8, where the term is fully explained, and where it is printed *Mvumvumu*. *Likawla* (p. 82) is printed *Likawla* (p. 84). Major Leonard's book is

¹ *Transactions of the Inverness Scientific Society*, 1885, vol. iii. p. 133.

² *The Lower Niger and its Tribes*. By Arthur Glyn Leonard (Macmillan, 12s. 6d. net), *At the Back of the Black Man's Mind: or, Notes on the Kingly Office in West Africa*. By R. E. Dennett (Macmillan, 10s. net).

larger and much more diffuse. Misprints are more frequent, but I shall merely refer to some which occur in an interesting Appendix on the "Grammatical Construction of Tongues." On page 507, *Ta*, to chew, should be *Ta*, as it is printed on page 512, where, however, *tuka* should be *kuta*, and *utaja* should be *utaha*. On page 510 some use is made of diacritical marks in the word *oyükhä*, but no explanation is given anywhere as to the meaning of these marks, and other words, usually written with them, do not receive them. On page 508 the first rule is badly stated, and the rule for comparison of adjectives is wrong, for *etiakan* does not mean "extremely good" but "better than" (*lit.* good past). It is a pity that these and a number of other mistakes have crept into this very interesting Appendix. The index is far too meagre, and it is quite impossible to locate many of the towns mentioned in the text on the antiquated map at the end of the volume.

In both volumes insistence is rightly laid on the effect of environment on the religious ideas of the natives. Major Leonard, in his opening chapters, gives a vivid description of Nigeria—a land baked and hard in the dry season, but swampy and malarial in the rains, and he seeks to trace the influence which these climatic changes and other natural phenomena had on the minds of the people. If there is less description in Mr. Dennett's book, it is not less necessary to keep before us as we read, a picture first of the Mayombe and Xiloango country and afterwards of the Benin River District. The conclusions arrived at by these two investigators seem at first sight vastly different. Says Mr. Dennett, page 105, "In the last resort the Bavili are monists," and he afterwards on more than one occasion makes the same statement regarding the Bini, *e.g.* page 235, "We have noted that both the Bini and Bavili in the first place recognise God." He then finds amongst both peoples a distinction between things created and things procreated—the former connected with God, the latter with the Devil. He lays stress on the fact that the ultimate starting-point for all is God, but he admits (p. 166) that the idea of God prevalent to-day amongst the Bavili is very degenerate. Trade, especially the slave trade, and European misconceptions regarding their civilisation, have demoralised the people so that they do not to-day lay the stress they should and formerly did lay on God's part in the affairs of the world. Accordingly he arrives at Major Leonard's conclusion that for all practical purposes the natives to-day are dualists (*Lower Niger*, p. 129), though the latter does not think that Monism ever existed in Nigeria.

Both writers rest their conclusions to a large extent on arguments of a philological character, and rightly so. But the study of West African languages is still in its infancy, and the conclusions drawn are sometimes hardly convincing. Thus Mr. Dennett pleads for Monism because everything is ultimately brought back to God—*Nzambi*. But *Nzambi* is not the causing First Principle. Though His name is singular in form, He contains the "essence of the forms," and has in Himself a male and female part (p. 167). It would seem quite probable that if the Bavili have fallen from Monism, they had originally fought their way to it from Polydemonism, or, to use Major Leonard's term, Naturism.

It is only natural that whilst one who has tried to get at the heart of native ways of thought, and to observe native customs, finds much to agree with in both books, there should be many things that he does not agree with. I do not know the country that Mr. Dennett deals with, but I have had a good deal to do with several "Bini Boys." Major Leonard's observations have mostly been made on the Niger amongst the Ibo people, but he has travelled through a great part of the country, and has gathered information from natives of all parts. Accordingly he feels justified in stating his conclusions broadly, making them apply to the whole of Nigeria. Thus he states, page 293, "Virtually, indeed, every household has its own priest in the person of the eldest son," and this statement is fully explained on page 395. Amongst the Efik and Umon peoples on the Cross River I have not found it so. The head of the family is the priest for the family. Amongst polygamists there is often doubt as to who is the eldest born, and accordingly, in these tribes at least, the father regards as his first-born the son of whose birth he hears first, even although, because of a slave's dilatoriness in carrying a message, or because of a child being born in a distant farm, he is really junior to another by several days. Further, the custom of the Nsibidi Society seems to me inconsistent with the position of the eldest son as priest. This society was suppressed in Duke Town in 1878 or 1879, but it was "out" in Creek Town in 1902, though it did no damage. Its members had the right on its "play" days to kill at sight the eldest son or daughter of any house whatsoever. Other children could walk the town with safety. It seems hardly possible that the people would submit to have their family priest in continual danger. Mr. Dennett does not seem to have found traces of this special sanctity of the eldest son, and facts like the above do not agree with it.

Amongst the Bavili there does not seem to be any human sacrifice. At least no mention is made of it in *At the Back of the Black Man's Mind*. Major Leonard has a great deal that is interesting to say about it. Among the Inokuns this religious rite was performed till after the Aro war, but now it has ceased. Indeed the custom was universal, and within the memory of man was practised even in Calabar. Some time ago I got a full account of the change from human to other sacrifices in connection with an *idem* at Okpökö, a farm village near Ikunetu. Formerly there was sacrificed to this *idem* a light-coloured woman—*owoafia*. But—and this is an interesting part of the tradition—about forty years ago the *idem* itself said that this was not good, and told the people to bring other sacrifices. Accordingly a white cow was offered. Gradually the value of the sacrifice decreased, till at last it became merely one white egg. With this meagre offering the *idem* was offended and in 1902 declared that no sacrifices save those that used to be offered would be accepted. The people understood this to involve a return to human sacrifice, and next day led a light-coloured woman to the sacred place and turned her face toward the *idem*. This was done to remind the *idem* that human sacrifice had been discontinued at its own command. Then were sacrificed "a white cow, a white fowl, a white tortoise, and many other animals, all white." Since then they have not sacrificed to the *idem*, nor

planted in that place. So the *idem* is offended and has gone to another part. This is proved, because the tree in which the *idem* lived is dead. In revenge for the way it has been treated, the *idem* has sent an *ekpo* (devil) to Okpökö, and this *ekpo* lies in wait for Ikunetu people going up-river and kills them—evidently the *idem* takes in this way the human sacrifice that was denied it. It is stated that many people from Ikunetu have lost their lives through this *ekpo*.

I have told this story because it illustrates the power that the old killing customs still have over the minds of the people. Till these are got rid of, it seems hopeless to expect the people to make progress. Both Major Leonard and Mr. Dennett think that the hope for the future of the black man—Bantu and Negro—lies in the development of their customs. This is true if development involves the loss of a good deal that has grown up during the centuries and the retention only of what is best in the customs of the people. Can this be done? Will it be that the native of Africa will lose his tribal exclusiveness and take a human view of life, and yet retain his present religious ideas? Is it possible to keep the family system, and yet cast out the ancestor-worship on which it rests? There is no doubt that Christian missions are influencing the people. So far the missionaries have practically left the principles they teach to influence the lives of their converts and gradually to transform the social fabric. This is the slowest way, but it is the wisest, because it involves least loss of what is good in the old state of affairs. But as surely as Christianity broke down the slave system of Rome, and the serf system of mediæval Europe, so surely is it having a revolutionary effect on the system of domestic slavery in West Africa. Its progress cannot be stayed, and however much we may regret the passing of many of the old customs, they cannot for long endure before customs which, because resting on a higher idea of God, are nobler and truer. Meanwhile let us learn all we can regarding the older customs of the people before they pass for ever. It is because of the insight and the sympathy that Mr. Dennett and Major Leonard have brought to their work that their books are so interesting and so valuable.

J. K. MACGREGOR.

GEOGRAPHICAL NOTES.

EUROPE.

Old Italian Charts.—The magazine of the Società Geografica Italiana for November has an article on certain nautical charts in the Communal Library in Bologna. They do not belong entirely to the "glorious epoch" of Italian mapmaking, from the end of the thirteenth to the middle of the sixteenth centuries, but they are still notable productions. They are: (1) The Atlas of Count Ottimano Freducci, dated 1538; (2) Atlas of Giacomo Scotto, 1593; (3) Nautical Chart of Vincenzo Demetrio Volcio, 1601; (4) Nautical Chart of Placido Caloiro,

1639; (5) Atlas of Placido Caloiro, 1665; (6) Atlas of Trofimo Vernier, 1679; and (7) an anonymous atlas.

These have all been described before, but the present article gives more detail. There are many points of interest in these later charts, showing, for instance, the steps of transition from the mediæval to the modern map. The Commune of Bologna also possess a splendid atlas of Candia, drawn by hand by Francisco Basilicata, from 1636 to 1639, dedicated to Andrea Vernier.

The executive of the Geographical Exhibition to be held in Venice next May promise to show a display of cartographical treasures, and it is just possible that visitors may have an opportunity of seeing these old charts.

ASIA.

The Lake of Pangong.—In the *Journal of Geology* (vii. 1906) Mr. Ellsworth Huntington gives an account of this lake, which he visited on his way to Chinese Turkestan. The lake, which lies in the province of Ladakh, or Little Tibet, is the last of a series of five connected lakes lying at a height of 14,000 feet. The upper lakes are in Tibetan territory, and drain into one another so that they are fresh, but Pangong, which has no outlet, is saline. At the time of Mr. Huntington's visit, at the beginning of May, the lake was still frozen, and the minimum air temperature at night was from 21° to 29° Fahr. The inhabitants were then just beginning to sow barley, the only crop which will ripen. This May-sown crop is reaped in September, and at the lake level usually ripens, but at Phobrang, a few hundred feet higher, it often fails, the limit of cultivation being thus reached.

The origin of the lake is of some interest in connection with the question of the glacial origin of lakes generally. It has been stated that the basin is due to the damming of an old outlet by fans formed by tributary torrents, but the author is of opinion that this is an error, and that there must be a rock lip which blocks the outlet. He considers further that the probabilities are that the basin behind the lip has been eroded by ice, and that it thus resembles the fiords of Norway and the valley lakes of Switzerland.

Another interesting point about the lake is that its lacustrine deposits and shorelines indicate that it is subject to constant oscillations of level due to variations either in rainfall or evaporation. The possibility that such variations are taking place simultaneously over a large area in Asia suggests that the detailed study of these variations may cast much light upon the recent history of climate.

A New Volcanic Island.—The *Times* recently reported the appearance of a new volcanic island off the Burmese coast, and some further details are furnished in a letter to *Nature* for February 18. The island is situated off the coast of Arakan, in the Bay of Bengal, about nine miles to the north-westward of Chebuda Island, and appeared above the surface of the sea on December 14. Its greatest length is 307 yards, and greatest breadth 217 yards, while the summit has a

height of 19 feet above high-water level. When visited by Commander Beauchamp at the end of December, the island was found to be still in an active condition at the northern end, where several springs of hot liquid mud were found. Elsewhere the surface had dried in the sun, and would support the weight of a man. Mingled with the mud of which the island is composed a few fragments of angular stone were found, and an interesting point was the amount of drift-wood which had accumulated in the short period which had elapsed between the origin of the island and its being visited. The naturalist of the party collected no less than fourteen kinds of seed. In view, however, of the nature of the constituent material it is improbable that the island will endure for more than a short period.

AUSTRALASIA.

A New Zealand Geyser.—In the course of a short article in the *Geological Magazine* (Nov. 1906), Mr. M. Maclaren gives an interesting account of a short-lived New Zealand geyser. This geyser—Waimangu by name—was discovered in January 1900, though it had probably been in existence for a short time previously. Its basin was some 130 feet long and 80 feet wide, and was usually full of black muddy water. It was active almost daily, but the eruptions were irregular in violence, sometimes hurling a mass of water estimated at 800 tons to a maximum height of 1500 feet, while at other times the geyser played lightly and intermittently for five or six hours at a time. For more than four years after its discovery the geyser was in active eruption, but during July and August 1904, it remained quiescent for nearly two months. This period was followed by renewed activity, which lasted till the end of October, when the geyser became extinct, and has so remained since. The interest of the case lies in the apparent connection with another phenomenon of the same region. Four miles to the north-west lies Tarawara Lake, which in June 1886 was effected by an eruption of Tarawara Mountain. The eruption threw a great barrier of ash across the valley which formed the natural outlet of the lake. The result was an immediate rise of the lake surface by 28 feet, and a slower subsequent rise which raised it an additional 14 feet by the end of October 1904. *On the very day* on which the geyser gave forth its last discharge the waters of the lake overtopped the barrier and rushed away, forming a tremendous torrent for a period of a few days until the level had sunk. This correlation in time certainly suggests that the waters of the geyser had a superficial origin, and the author mentions other New Zealand examples which tend in the same direction, and are thus opposed to the view of Suess that the waters of geysers have always a deep origin.

The Geological Survey of New Zealand.—We have received a monograph on the *Geology of the Hokitika Sheet, North Westland Quadrangle*, which forms Bulletin No. 1 (new series) of the New Zealand Geological Survey. The district of Westland includes the western watershed of the Alps of South Island, a region full of scientific and

geographical interest. The region is also of economic importance on account of the occurrence there of alluvial gold, and though gold is now only obtained in reduced amounts, the possibility of the discovery of gold-bearing veins of commercial value cannot be overlooked. Hokitika, the town which gives its name to the sheet under discussion, is a small settlement which owed its origin to the fact that it was in the vicinity of the Hokitika river that the first finds of gold were made.

As regards the general physical features of the district, the whole of the west coast is remarkable for its relatively low tree-line, despite the mild climate and the comparatively low latitude. On the lowlands trees are abundant, and the forests yield valuable timber, but at a height of about 3000 feet they become dwarfed to a low impenetrable scrub. This only persists about another 500 feet, and is replaced by an Alpine flora, which is again limited in extent by the very low snow-line. The rainfall is very heavy—an average of 117 inches per annum as against 51 inches at Wellington. Rain falls on an average 177 days per annum, and the wettest month is October. The mean annual temperature is 53° F. In 1906, a year of unusual cold, Pope's Pass (5290 feet) was almost covered with snow at the period of maximum melting, while snow fell at a height of 3000 feet during each of the summer months.

The glaciers of the region are small and of the Piedmont type. They have little, if any, excavating power, and very little morainic matter is now being deposited. The glaciation of the region seems to date from the Miocene, and apparently reached its maximum in Upper Pliocene or early Pleistocene times, since which time it has gradually diminished. From the point of view of topography the district can be divided into three regions—the alpine chain, with in the district a maximum height of 7197 feet (Mount Rosamond); an elevated peneplain with a mean height of 4000 to 5000 feet; and a coastal plain. Some fine illustrations show the characters of these different regions. The coastal plain is interesting, because it is covered by a great sheet of morainic and fluvatile deposits in which are found the auriferous deposits. The whole of the glacial débris seems to be auriferous, but it is only worth working where a natural process of concentration has occurred, and the richer leads appear now to have been all exploited.

POLAR.

The Structure and Topography of Graham Land.—Mr. Gunnar Anderssen gives in the *Bulletin of the Geological Institution of the University of Upsala* (vii. 1904-5) an interesting account of Graham Land, based upon the researches of the Swedish Antarctic Expedition. He points out that the land-forms of the region, here as usual, are intimately connected with the geological structure of the ground, thus making it possible to make rather wider statements as to geology than actual observations justify. By far the larger part of the area in question is made up of a series of plutonic rocks similar to those found in the Andean Cordillera, mingled with displaced and folded sedimentary

rocks. The landscape so formed is highly mountainous, with narrow peaks and rugged crests. The ice-cover is generally incomplete, leaving bare many lofty mountains, only the more gentle slopes being covered with inland ice. The large valleys are filled with great glaciers, and even where the whole surface is ice-covered the swarms of crevasses and the hummocks reveal the unevenness of the ground beneath. On the other hand, on the east coast of the mainland, there are broad promontories and large islands, as Ross Island and Vega Island, of very characteristic shape. This is a typical plateau-region with its horizontal surface covered by slightly vaulted inland ice, the coastline being formed by dark vertical cliffs. These cliffs show clearly the composition of the area, being formed of a coarse basaltic tuff sparingly intercalated with lava flows and dikes. The centre of the region is in Ross Island, which rises in the centre to the huge conical Mt. Haddington, possibly a large volcano. The third type of landscape is found in the Snow Hill and Seymour Island region, and is interesting because it is the only considerable region which is free from land-ice. The reason, perhaps partly to be sought in special conditions of temperature, etc., is apparently chiefly the nature of the rocks, which are soft sandstones of Cretaceous and Tertiary age. These sandstones are easily acted upon by water, and the regions where they occur are therefore low and deeply dissected. Only in this region does melting of the snow occur to any considerable extent in summer-time. The illustrations by which Mr. Anderssen's article is accompanied show admirably the different types of scenery in the three regions mentioned.

As regards glaciation and the ice-covering, it is curious to note that, extensive as is the latter, the existing glaciers are far from active, and in the northern part of Graham Land at least the only icebergs produced are small and irregular in form. The characteristically Antarctic tabular bergs met with by the expedition must therefore have come from further south. At the same time there are clear indications that glaciation was formerly much more powerful than at present. At the southernmost point reached by Nordenskjöld evidence was found that the inland ice formerly rose 300 metres higher on the side of the Borchgrevink nunatak than it does to-day.

Another point upon which the paper lays great stress is the remarkable similarity both as regards orography and geological structure to be observed between Graham Land and South America.

Meteorology in the Antarctic.—In connection with our previous note on this subject (p. 96), we may state that Mr. W. S. Bruce has received word of the arrival of the *Uruguay* at Scotia Bay, South Orkneys, with Mr. Angus Rankin's party on board. The vessel encountered hundreds of icebergs, and heavy pack ice, and was considerably damaged. The party at the Observatory were found to be in good health, and to have accomplished a year of excellent work.

New Arctic Expedition.—According to the *Athenæum* the Duke of Orleans is preparing to lead another expedition to the Arctic in the

yacht *La Belgica*. Captain de Gerlache will be in command, and the crew will consist of men who have already had Arctic experience. It is expected that the expedition will sail from Ostend in the middle of April.

COMMERCIAL GEOGRAPHY.

The Production of Cereals in France.—A short note on this subject in the *Revue Générale des Sciences* for December 15 gives some interesting facts. The area devoted to cereals in France oscillates about 37 million acres (15 million hectares), that is, covers about 28 or 29 per cent. of the whole area of the country. About half the total is given up to wheat, but this will no longer pay as a sole crop, though it does well in rotation, especially with beet. The areas given to wheat and barley are slightly decreasing, while that covered by oats is stationary. In 1905 the total production of wheat in France was 327 million bushels (119 million hectolitres), and though far behind Russia and the United States she ranks third in the list of producing countries. But in spite of this enormous production she does not produce quite enough for her own wants, her exports of wheat, oats and barley, never quite equalling her imports. Much of the excess is furnished by Algeria and Tunis, and Russia also sends corn to France. The price of home-grown cereals is no longer determined by local conditions, but by the prices which reign in the great markets of the world. This is due to the constant diminution of the price of transport across the ocean, so that now it costs less to bring wheat from New York to Havre than to bring it from Havre to Paris.

The Commercial and Colonial Expansion of Modern States.—The *Revista Coloniale*, official organ of the Institute Coloniale Italiano, whose *début* we lately noticed and welcomed, is justifying its existence by the character of its contributions. One excellent feature is, that debates in the Senate on Colonial questions are quoted *in extenso*, so that those interested may refer to them with facility, without having to turn over old files of newspapers. The second number reports a discussion in the Senate, inaugurated by De Martino, on the necessity, among other things, for the reform of the Consular Service, which some of us might do worse than read.

In the third number there appears a most interesting article by Dr. Filippo Carli, secretary to the Chamber of Commerce in Brescia, entitled "Technical Education and Economic Expansion." The occasion for it is a book just issued by Marco Fanni on "The Commercial and Colonial Expansion of Modern States," and Dr. Carli uses it as a text from which to evolve his own views on technical education. The book itself should interest us, because the author's prognostications concerning the future of Great Britain are most gloomy, and while we may not share in his alarm, it is useful to know what impression we produce on our neighbours. Carli differs from him on one important point, and uses this very divergence to illustrate his own opinions. Fanni, it seems, believes that the

phenomena of expansion are purely material. As he puts it, "the colonial expansion of the different countries depends on their commercial expansion, and that in its turn on the increase of population." Again, "the impelling force of economic, social and political progress, is the increase of population." Nothing is allowed for racial differences, nothing for superior training; the only difference is in geographical position. For instance, the northern nations were less agricultural than the southern from their geographical position, and so had to develop their industries in order to purchase food-stuffs.

Carli traverses this view entirely, dwelling on the great force of what he calls the spiritual element, which includes technical education. Technical education influences economic expansion in two ways: (1) as the co-efficient of industrial development, and therefore indirectly as a power in the conquests of markets; (2) as the direct coefficient in commercial penetration.

From these two points of view Germany is held up as a great example. Directly after the Franco-Prussian War, she set herself to educate her people. The diffusion of technical education began in Prussia in 1876; in Württemberg the most important industrial schools began in 1893-94; the great school for textiles in Planen was founded in 1877; the similar one in Berlin started in 1875; and many others had their beginning about the same time. We know what the result has been; how Germany has advanced by leaps and bounds in the commercial world.

So much for industrial development. When we consider commercial penetration, Germany very wisely says, "It is not enough to have goods of the best quality, produced to undersell our rivals. We must make the consumer aware of their value." Hence comes the development of the consular service. The modern German consul is a trained man of business. The whole of the German trade centres in his office to be fostered and encouraged by him, and he is never above his business.

Rubber Cultivation in Ceylon.—The last issue (1906-7) of Ferguson's *Ceylon Handbook and Directory*, a volume of great value which has just reached us, contains some statistics as to the area under rubber in Ceylon which have, or are likely to have in the immediate future, considerable economic importance. In July 1905 Ceylon had about 40,000 acres planted with rubber, but so rapid was progress in the following year that in little more than a year the acreage leaped up to 100,000 acres, not counting the acreage of native gardens, which is considerable. In the Malay Peninsula there are probably about another 60,000 acres. As yet these plantations, almost all of recent origin, produce only a few hundred tons, and thus do not seriously compete in the market with the supplies from South America and Africa, but there is a probability that in another six or seven years Ceylon and the Malay region with Java will be each in a position to put about 10,000 tons on the market. It will be remembered that in South America and the Congo Free State it is the wild rubber which is collected, and there is some doubt whether tropical Africa at least can long keep up the present rate of supply. As both Ceylon and the

Malay region are in different ways well fitted to cultivate rubber, Ceylon especially having a good and cheap supply of labour, there can be no doubt that Africa at least will have to alter her methods if she is not to lose her market. It is one of the curious little facts with which economic geography abounds that at the present time Ceylon is supplying seed to Brazil, from which her own plants of Para rubber were originally obtained.

A very interesting account of the development of rubber cultivation in Ceylon will also be found in *Nature* for December 27, in an article by Dr. J. C. Willis, which also gives some account of the Rubber Exhibition held at Ceylon last September. The Report on this Exhibition, containing the lectures and discussions which took place at it, has also been sent to us by Messrs. Ferguson of Colombo. Further, the indirect effect of the cultivation of rubber in Ceylon in stimulating interest in its cultivation in South America will be found discussed in a paper by M. Paul Le Conte in the *Bulletin mensuel* of the Société de Géographie Commerciale de Paris for November last.

GENERAL.

The British Association.—We have received the usual intimation in regard to the Meeting of the British Association, which is to be held this year at Leicester, beginning on Wednesday, July 31, under the Presidency of Sir David Gill. The President of Section E (Geography) is to be Mr. G. G. Chisholm. An attractive programme of excursions is being arranged, the geologically famous Charnwood Forest area being within easy reach of Leicester by rail or road. The Honorary Local Secretaries are Messrs. Alfred Colson and G. V. Hiley, Millstone Lane, Leicester.

EDUCATIONAL.

IN the December issue of the *Revista Geografica Italiana* there appears a suggestive article on Professor Cvigić's monumental work on "Human Settlements in the Servian Countries," especially interesting in connection with the distribution of cities and villages in the region. These two types of settlement have, of course, a widely different origin, for while the situation and character of a village is determined solely by the local topographical conditions, the choice of the site of a city is influenced by many concurrent factors, such as the great arteries of communication, the rivers, the seaports, and their connection with foreign countries.

If we consult the map of the Balkan Peninsula, it will be noticeable that the western division differs in character from the eastern. In the former, the country is divided up by mountain ranges running north and south, with deep and sunless valleys between them; while towards the east, the mountains are irregular in outline, enclosing circumscribed depressions and valleys which only with difficulty communicate with one another. Again, it will be seen that the Peninsula is intersected

longitudinally by the great Morava and Vardar valleys, and transversely by the ancient Via Egnatia. In a climatic sense the country is also divided up, for while the northern slopes are densely wooded, and are subject to all the weather conditions of a forest land, the southern division is arid and devoid of vegetation. These geographical peculiarities are reflected in the settlements. Of villages there are two types, roughly speaking, the *sparse* and the *united*, and it will be found that the line of division runs from north-east to south-west, that the sparse type prevails in the north-west, and the united in the south-east. As might be expected, the long ranges of mountains with their sunless valleys, full of water, encourage the inhabitants to settle high up on the ridges, in the sun, and the condition that is found is that of long straggling villages, each house apart from the others and surrounded by its fields. The wooded condition further favours this tendency to isolated farms. In the south-east, on the other hand, where the isolated valley and the absence of forest lands prevail, the villages are at the bottom of these valleys, the houses being huddled together, often back to back, and the pasture lands are situated at a distance on the hillsides.

The cities, again, are naturally found along the main arteries of communication already alluded to, along the great highway of the Morava and Vardar, from Salonika to the Danube; by the Via Egnatia from the Black Sea to the shores of the Adriatic; and in the north along the line of the Save and Danube, one of the most striking examples being Belgrade itself, situated as it is at the junction of the Danube and Save. One sees how these cities wax and wane in prosperity in sympathy with the fortunes of the seaports and the foreign traffic. For instance, up to the early part of last century the bulk of the traffic went and came by the Adriatic ports, whereas since then it tends to take the northern routes towards the Danube, and the prosperity of the former cities and ports has suffered in proportion.

While there is, of course, nothing new in the above conception, the particular application is interesting.

We publish this month a short note on the cultivation of rubber in Ceylon which may be recommended to teachers as affording material for an interesting lesson. Though as yet the cultivated rubber does not command so high a price on the market as the wild product, yet the probabilities seem to be that there will happen in this case what has already happened in the case of cinchona. We gave here some time ago (xx. p. 321) a short account of the work done by the Dutch in the acclimatisation of that plant, and the consequent loss to South America of much of its market for the product; and it would seem that the painstaking work which has been done in the case of rubber is likely to have similarly its reward in the capture by the eastern planters of the rubber market. If this occurs, or if the East can even seriously threaten the South American and African monopoly, the probabilities are that extensive social changes in, for example, the Congo Free State will necessarily take place, and there is something very stimulating to

the imagination in the slow conquest by scientific methods of an industry hitherto conducted on primitive and slovenly lines.

According to an article in *Science* for December 21, the Geographic Society of Chicago has been interesting itself in the development of instruction in meteorology throughout the United States. It has collected a set of 270 lantern slides of various meteorological subjects, and has compiled a descriptive text to accompany them. The slides have been copied from the *Atlas of Meteorology*, recent text-books, the *Monthly Weather Review*, and from photographs, etc., while the text has been compiled under the auspices of an efficient committee. The text includes a bibliography for the use of teachers, and the whole is available at cost price. The idea is an admirable one, and deserves to be further developed.

NEW BOOKS.

EUROPE.

Modern Spain, 1815-1898. By BUTLER CLARKE. Cambridge : At the University Press, 1906. Price 7s. 6d.

This is another volume of the Cambridge Historical Series, which quite sustains the high level which the previous works have accustomed us to. The aim of this series is, as the editor says, to sketch the history of modern Europe with that of its chief colonies and conquests, and it is intended for the use of all persons anxious to understand the nature of existing political conditions. As indicated in the title, *Modern Spain*, after an introductory chapter touching on the time of the Peninsular War, or as the Spaniard calls it, the War of Independence, takes the reader over that stormy period from 1815 to close on the present time.

The interest for the general reader will centre on the account of the Pragmatic Sanction and the resulting Carlist wars. Spain had always from time immemorial recognised the right of females to the throne of Castile and Leon in default of males, but Philip v. introduced the Salic Law in 1713. Later, in 1789, Carlos iv. set this law aside, and a decree was prepared which received the name of the Pragmatic Sanction, and which had the effect of restoring the former conditional rights of females. But it was never promulgated, and therefore, as Don Carlos insisted, never became law. Forty years later, when it was known that Doña Christina was to become a mother, Ferdinand proceeded to the due promulgation, but it was too late. Hence the Carlist wars, and all the horrors of civil warfare. The first Don Carlos seems to have been a scrupulous and honourable gentleman, and to have behaved throughout with great gallantry. But for this, his descendants might have ruled over Spain.

Many familiar figures flit across the pages as we read. Espartero, the brilliant soldier but unscrupulous politician; Serrano, the gay and gallant lover of Isabella; Cabrera, the brutal Carlist leader; and certainly not least, Queen Isabella herself; how she was made a pawn of and wronged by her scheming Neapolitan mother.

An important addition to the volume is the copious bibliography. No work is included which is not considered trustworthy, and on this account we are glad to observe that the *Episidios Nacionales* of Perez Galdós have an honourable mention, for they are delightful reading and full of quiet humour.

It is with great regret that one reads, in the sympathetic memoir, that the

author died just as he had completed this work. He was an enthusiastic lover of Spain, and by his extensive acquaintance with Spanish literature and history, was unusually well qualified for the task which he undertook.

Britain and the British Seas. By H. J. MACKINDER, M.A. With Maps and Diagrams. Second Edition. Oxford: Clarendon Press, 1907. Price 7s. 6d.

This book has so rapidly acquired the status of a classic that all geographers will welcome the appearance of a second edition. The alterations are trifling; we notice that some, but not all the misprints, etc., noted in our previous review (xviii., p. 325) have been corrected, and it is naturally gratifying to us to see how often the *Scottish Geographical Magazine* appears among the new references added.

As a point of special interest to our own readers, we may notice that on p. 127 it is stated that the Avon has probably captured the head-stream of the *Dee*, *Dee* being obviously a misprint for *Don*.

Illustrated Handbook to the Perthshire Natural History Museum, and Brief Guide to the Animals and Plants of the County. By ALEX. M. RODGER, Curator. Second Edition. Perth, 1906. Price 3d.

This pamphlet was reviewed in vol. xxi. p. 507. The new edition is slightly modified in form, and has some additional illustrations, and also a sketch map of Perthshire. Otherwise we have only to repeat our former words of praise.

Sketches from Normandy. By LOUIS BECKE. London: T. Werner Laurie, 1907. Pp. 250. Price 6s.

The title, be it noted, is not *of* but *from* Normandy, and really the locale is unimportant. The sketches are mainly of people,—tourists, French domestics, French children. Also they are concerned with dogs, shooting, the *entente cordiale*, etc. They are light and abound in amusing incidents.

The Heart of Spain: An Artist's Impression of Toledo. By STEWART DICK. London and Edinburgh: T. N. Foulis, 1907.

The result of Mr. Dick's sojourn in Toledo is a very pleasant volume, breathing the fascination of the place. As he truly suggests, it is a city peopled with the ghosts of old-time warriors, Goths, Moors, and Christians, jostling one another in the narrow streets. Zorrilla, indeed, in one of his dramas represents this feeling, and as one looks over the ramparts by the light of the evening sun, the impression is produced that with a very slight stretch of imagination one might see the armour of the hosts of the Catholic Kings glinting in the distance.

Mr. Dick's illustrations are admirable, especially the sketches in colour, which most faithfully reproduce the colouring of Toledo and the country round. Those who have visited Toledo will feel that in turning over the pages of this volume they are making a return journey in the company of "one who knows."

We cannot make up our minds to share his high opinion of El Greco, having a recollection of sundry nightmares by him on the walls of the Prado.

My Experiences of the Island of Cyprus. By B. STEWART. Illustrated from Photographs by the Author. London: Skeffington and Son, 1906. Price 6s.

Cyprus is seldom written about, and Mr. Stewart's account of the British isle in the north-west corner of the Mediterranean Sea is all the more interesting. He

makes no pretence to literary style, but tells a plain, unvarnished tale, with sufficient sprightliness to produce a readable book. He has been twice in the island in recent years, first as an engineer in connection with the railway, and the second time (in the early months of 1906) revisiting old scenes. Cyprus is a wretched island, suffering from extremes, deluged at one time with rains, and at another time burnt to a cinder by the heat. Mosquitoes abound, and ophthalmia is common. "What a desolate and unhappy-looking country Cyprus is!" is the exclamation again and again of the traveller gazing on the broad stretch of country. To add to its drawbacks, it seems to be badly served for post-office and trade purposes by the steamship companies. In the dashing years of the forward Colonial policy of 1895 and onwards, British money was flung at it, and squandered on harbours nobody uses, and on railways on which nobody travels. British capital has also been sunk in trying to utilise the land, but it has been a hopeless enterprise. While the island is administered by Great Britain, it is still, according to the one-sided treaty of 1878, a part of the Turkish Empire, and on certain conditions being fulfilled, Britain may evacuate it at any time. This doubtless impedes the development of the island; indeed it is gravely alleged "British administration has done nothing for Cyprus," in spite of a yearly grant of over £30,000 from the Imperial exchequer. The only useful outlay has been in the making of country roads. It is also remarkable that it is the Greek flag that is almost universally used, and the Union Jack is seldom visible. Mr. Stewart has a good deal to say about the churches in Cyprus, and enriches his book with many excellent photographs of them. He also gives a brief and succinct account of its history and of its few antiquities. If Cyprus is to redeem its past, it is time the Turkish bond was broken, and Britain's flag allowed to fly with undisputed authority over the whole island.

ASIA.

Persia Past and Present: A Book of Travel and Research. With more than 200 Illustrations and a Map. By A. V. WILLIAMS JACKSON, Professor of Indo-Iranian Languages in Columbia University. New York: The Macmillan Company. London: Macmillan and Co., Ltd. 1906. Price 17s. net.

We have here an important contribution to the historical geography of western Persia. It is not an ordinary traveller's tale, but the work of a competent scientific investigator and interpreter, prepared, as every page proves, with great care and elaboration, and written in a clear and graphic style. The author is professor of Indo-Iranian languages in Columbia University, and was for a time adjunct-professor of English language and literature. *Primâ facie*, the tenure of these offices is warranty of his being a man of culture and learning. This book wholly confirms the impression. As an ardent student of the ancient languages and religions of the East, Professor Jackson had previously visited India and Ceylon, and by personal investigation had learned among the Parsis of Bombay, descendants of the old Zoroastrians and preservers of their traditional beliefs and customs, much about the ancient Magian religion, its sacred writings, and the past history and present condition of its votaries. He had in 1899 written a life of Zoroaster, the prophet of ancient Iran, sage and reformer, "representative and type of the laws of the Medes and Persians," "the forerunner of those wise men of the East who came and bowed before the majesty of the new-born Light of the world." In that book he endeavoured to picture for the reader the somewhat shadowy figure of the prophet, and to sift from the heap of legend, tradition, and classical allusion the facts of his life, times, and teaching. In the

present book the author again appears as an enthusiastic and laborious inquirer into things old and new : a well-equipped linguist, acquainted with the various scripts to be found in western Persia from the Accadian or Assyrian cuneiform to the modern cursive Persian, and familiar with the records of historians and geographers from the Achaemenian rock-inscriptions and the pahlavi texts of the Sasanids to the writings of mediæval and modern Arabs and Europeans.

The plan of the journey described in this book was, says Professor Jackson, to traverse as much of the territory known to Zoroaster as possible, and to visit the places most celebrated in the history of Persia. Entering the country from Russian Transcaucasia by way of Tiflis, Erivan, and Julfa, he visited Tabriz, and traversed the Zoroastrian region round Lake Urumiah. Thence he proceeded southward to Takht-i-Suleiman (the ruined site of Gandaka and the great fire-temple of Adhargushnasp), and Hamadan (the ancient Median capital, Ecbatana). From there he visited the Ganj Namah trilingual inscriptions carved in cuneiform on Mount Alvand by Darius and Xerxes. From Hamadan also a digression westward to Kermanshah was made, in the outward and return courses of which he scaled, at peril of limb and life, the great Behistan rock and examined its famous inscriptions ; inspected the grottoes and bas-relief sculptures of Tak-i-Bostan, with which is associated the legends of Khosru, Shirin, and Farhad ; and identified at Kangavar the ruined temple of Anahita, the Persian Diana, whose worship was widespread in Iran in the fourth century before Christ. Continuing the southward journey from Hamadan, the author arrived at Ispahan, the former capital of the modern Shahs of Persia, where he found resident a few families of Zoroastrians or Parsis, the first he had met in Persia. He then went on, first to Pasargadæ, on the plain of Murghab, the royal seat of Cyrus, where the great monarch's column and tomb still bear his epitaph ; and then, forty miles further south, to Persepolis, the imperial city of Darius and his successors, the magnificent ruins of which attest its once regal splendour. Finally, the author reached the southern limit of his journey, Shiraz, the home of Saadi and Hafiz. Thence returning northwards he visited Yezd. The largest community of Zoroastrians in Persia, numbering several thousand souls, is established there ; and in intercourse with them the author found the chief occupation and interest of his stay in Yezd. Thereafter he proceeded to Teheran, whence he visited Rei, the Rhaga or Rages of antiquity, the traditional home of the mother of Zoroaster ; and subsequently left Persia by way of Kasbin and Resht.

The purpose of the journey, again says the author, was in the first instance antiquarian study and scholarly research, especially with regard to Zoroaster and the ancient faith of the Magi. But he likewise observed and for himself investigated, and in this book has described, many of the geographical features and historical problems, as well as the ancient and modern manners and customs, of western Iran. Further as he went along, he noted, and has depicted, the conditions of domestic and national life and economy, and the incidents and accidents of travel, in the Persia of to-day. He has thereby succeeded in producing a most interesting and well-illustrated book of modern travel for the general reader ; and for the special student a work enriched and illuminated by the results of solid learning and of careful research into the past and present records and history of the field of travel.

Tibet, the Mysterious. By Sir THOMAS HOLDICH. With Maps, Diagrams, and other Illustrations, and Map by W. and A. K. Johnston. London : Alston Rivers, Ltd. Price 7s. 6d. net.

This volume of "The Story of Exploration" Series is a useful and timely
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addition to the series. The account given in it of the explorations which have gradually, more especially during the last thirty or forty years, substituted accurate knowledge for fable and ignorance, may be taken as putting into readily intelligible and reliable form the geographical results of those explorations and their possible political and commercial effects. It also shows the great extent of work of first-class importance from a political and commercial point of view, principally in eastern and south-eastern Tibet, that still awaits the explorer. A beginning not wanting in promise has, through the late military expedition from India, been made in the penetration into Tibet of European influence friendly to Great Britain. The hope seems not unreasonable that, by virtue of tact and patience and the avoidance of haste on the part of the invader, the next quarter of a century may see the establishment of freer intercourse and of better means of communication with Tibet, and the opening up of the territories, as yet scarcely trodden by the explorer but apparently rich in resources and population, that lie on its south-eastern borders. Nor ought it to be overlooked that while we have been disposed to rail at the exclusiveness and obstruction of the ruling powers in Tibet, the same attribute and attitude are to be found, and have been quietly acquiesced in on the Indian side of the great Himalayan divide, within our own immediate sphere of political and commercial influence. What of Nepal? It is a country practically unvisited by—almost completely closed against—the European explorer and trader. Not even the courses of some of its great rivers—the Kurnáli, the Gandak, the Kosi, and their affluents—which debouch into the Gangetic valley, have been tracked through it by our geographers to their sources on the Indian or the further side of the Himalayan watershed. In ancient times intercourse between India and Tibet across the central and eastern Himalayas was undoubtedly freely carried on. According to tradition the first king of Tibet was a native of India, son of the king of the eastern Gangetic kingdom of Kosila; and Buddhism probably permeated Tibet principally through the same avenues from India. It may safely be said that but for the interposition of the exclusive principalities of Nepal, Sikkim, and Bhutan, British communication with and influence in Tibet would long ago have been far greater than it is now. It seems high time, therefore, that the geographer and trader, backed by the Indian Government, should take these regions peacefully but steadily in hand.

As a literary production this book in its earlier chapters is not quite worthy of the reputation of the distinguished author of *The Indian Borderland*. The material available for the compilation of these chapters was no doubt slender and scanty, and vague in details. But from Chapter VIII. (in which the travels of Huc and Gabet are recounted) onwards, and above all in the chapters wherein the journeys of the intrepid explorers (European and native) from India are described, the narrative, though sometimes diffuse, lacks little in definiteness of outline or detail. The author is dealing with well-considered material with some of which he has firsthand and intimate acquaintance. Much of the material is not readily accessible to the ordinary reading public. To them therefore it is a very distinct boon to be presented with a consecutive account of the exploratory work which has been accomplished during the last few decades in the Tibetan region. In this account not the least gratifying feature is the hearty acknowledgment and appreciation of the part taken by the native Indian surveyors and explorers who, with rare fidelity to their employers, persistently carried out, through long periods of peril and privation, the duty intrusted to them.

A bibliography is appended to the book, which will prove useful to those who wish to refer to original authorities.

Before closing this notice, it may not be out of place to say that the identification by Huc of an Englishman who was reported to have lived at Lhasa from 1826 to 1838 with the traveller Moorcroft is not altogether probable, although the author of this book seems disposed so to accept it (v. chap. vii. 123-4). Moorcroft was a veterinary surgeon, who, after attaining eminence in his profession in England, in 1808 and being then over forty years of age, went to India to supervise the East India Company's horse-breeding and remount operations in northern India. After making his expedition into Nari Khorsum in company with Haidar Hearsey in 1811-12, he started in 1819, accompanied by an Englishman named Trebeck, on a journey to Turkistan through the Panjab (then ruled by Ranjit Singh), Ladak, Kashmir, and Afghanistan. His object was investigation, not only regarding the Turkoman horse for breeding purposes in India, but also into the general trade resources of those countries and the possibility of establishing mercantile relations between them and India. He was not, however, accredited by the Indian Government, which, on the contrary, discountenanced his proceedings and eventually stopped his pay during absence. He left Bokhara on the return journey in August 1825, but got no further than Andkhui in Afghan Turkistan, where he was said to have died, probably through foul means. Trebeck also was said to have died somewhat later at Mazar-i-Sharif. Some at least of their papers were recovered, and an account of their travels was published in 1841 under the editorship of the distinguished orientalist, H. H. Wilson. That, unknown to the Indian authorities, the report of Moorcroft's death was false, and that he made his way from Bokhara to Lhasa and lived there till 1838, seems scarcely credible.

Folk Tales from Tibet, with Illustrations by a Tibetan Artist and some Verses from Tibetan Love-Songs. Collected and translated by Captain W. F. O'CONNOR, C.I.E. London: Hurst and Blackett, Ltd., 1906. Price 6s. net.

This book hardly falls within the scope of geography, except that in these days geography lays claim to an interest in most mundane facts and affairs. Geographical or not, however, the book contains a capital collection of fables, very well told, portraying, chiefly under the guise of talking animals, the foibles and virtues of mankind in Tibet and elsewhere, and full of worldly wisdom not unmingled with guile. The folklorist will judge whether the stories are probably indigenous or exotic, ancient or modern. But in any case they prove that the Tibetan of to-day, who loves to recite them and to hear them recited, has imagination and humour, and in spite of lamas (grand and lowly), demons, wizards, and other causes of depression, has plenty of good spirits and is a happy-minded and sagacious enough fellow. The drawings are after the conventional manner of the country—a manner apparently derived from China as regards design and colour. The best picture (a photograph) is the frontispiece showing a Tibetan fabulist and his household, the former a jolly-looking old soul who is plainly capable of enjoying the narration of his tales as much as, the author tells us, the listeners are.

La Chine novatrice et guerrière. Par le Capitaine D'OLLONE. Paris: Colin, 1906. Price 3 fr. 50 c.

As Captain D'Ollone was commissioned by the French Government to visit and report on China, this work is not that of a passing traveller. He entitles it "Innovating and Warlike China," showing at once her willingness to accept changes and her determination to defend herself. After reminding us that Chinese history begins in B.C. 722, he describes graphically the constant wars which

occurred for the occupation of China down to its most glorious period, that of the great Manchu emperors, Kangsi and Kien-lung (1662-1799), the first British envoy, Lord Macartney, being received by the latter in 1759. From 1808 onwards, difficulties occurred with Britain in regard to the exportation of opium from India to China, the British fleet in 1840 bombarding Canton, taking Shanghai, threatening Nankin, and thus causing China to yield. The result of the "Opium War" was the treaty of Nankin in 1842, which opened China by according five treaty ports to British commerce, and ceded Hong Kong to Britain, this being the first dismemberment of China. France and the United States were afterwards accorded the same privileges of commerce. In 1851 the Taiping rebellion shook China to its foundations, and led to the French and British fleets seizing Canton, the Taku forts, and the mouth of the Peiho in 1857. In 1860 a French and Anglo-Indian force retook the Taku forts and burned the summer palace near Peking, after which the province, of which Vladivostok is capital, was ceded to Russia. At last, in 1864, after thirteen years of carnage during which 3,000,000 are said to have perished, the Taiping rebellion was quelled by the Chinese Imperial army capturing Nankin, the rebels' capital. The more recent dismemberments of China are the conquest of Indo-China by the French and British, and of Formosa and Corea by the Japanese, with the occupation of Kiao Chau by the Germans, and the cession of Port Arthur to the Russians, and of Weihaiwei to the British. The author points out that China consists of not one but many races, and resembles a Europe rather than a France or an Italy.

Buddhism, now the faith of four hundred millions of Chinese, was introduced from India into China A.D. 65, but it was not authorised by Imperial edict till 335. In 638 Mohammedanism was introduced from Persia, and in 744 an emperor had a religious service in his palace conducted by seven Christian priests. In 1293 the Franciscan, John de Monte Corvino, arrived in Peking, sent by the Pope, and was well received. Fourteen years later he was nominated Archbishop of Peking with three suffragan bishops. Foreign Christians, however, behaved so badly after their arrival in China, that they acquired the name of "foreign devils," and were massacred in the sixteenth century, but the Jesuits persevered, and, being learned men, converted many Chinese, even members of the Imperial family. The great Manchu Emperor Kangsi accorded liberty to the Christian faith throughout the empire in 1692. Dominican missionaries, however, protested against the Jesuit ritual and appealed with success to the Pope, which irritated Kangsi, who in 1717 issued an edict prohibiting the promulgation of the Christian faith. Pope Benedict xiv. issued a bull condemning the Chinese worship of ancestors and Confucius, and a terrible persecution of Christians occurred in 1746, which was renewed in 1838 owing to the opium war with Britain. In 1844 a treaty with France authorised Christian missionaries, and there are now forty-three bishoprics and 900,000 Roman Catholics in China, while there are 200,000 Protestants. There are thirty or forty millions of Mohammedans, and there is scarcely an important town without its mosque. Islam progresses daily in China.

After discussing administrative and social China, the author describes its modern transformation, beginning with the reforms from 1860 to 1900. The defeat of China by Japan in 1894-5 produced consternation, for the Chinese had always regarded the little Japanese with contempt and as vassals. Military schools directed by European and Japanese instructors were at once established at Tientsin, Nankin, and Hankow. Later, telegraphs were introduced, and there are now 33,000 miles of telegraph. Then railways were constructed and extend already to over 3000 miles, with concessions for 2500 miles more. Nothing is more remarkable than the way in which railways have become popular in China.

With regard to the new Chinese army, the length of service has been fixed at ten years, three on active service, three in the first reserve, and four in the second reserve, which will furnish a reserve of one million men. After the army reforms are complete in 1908, the authorities hope to still further increase the army till it reaches ten million men all armed with the latest weapons and thoroughly trained after the best systems. Education is likewise being reformed in China, and in 1902 the University of Pekin was reorganised and divided into eight faculties preparing for forty-six different callings. The schools have also been reorganised, and foreign languages are taught in the following order—English, Japanese, French, German, and Russian. What stands in China's way is lack of money, or rather (for the country is very rich), the Government do not know how to finance the reforms they would like to introduce. The author concludes by declining to say whether or not China is approaching its downfall or renaissance, and declares that he would be a bold man who would venture to prophesy regarding such a complex empire, of which, he maintains, "we know nothing."

British Malaya: An Account of the Origin and Progress of British Influence in Malaya. By Sir F. SWETTENHAM, K.C.M.G. London: John Lane, 1906. Price 16s. net.

This volume on British Malaya is not unworthy of the distinguished name of its author. From the first page to the last it holds our interest and our attention. It is partly an account of the Straits Settlements before and after they became a Crown Colony in 1867. It describes Penang and Wellesley with their entrancing beauty, Malacca with its romance and its records of by-gone European adventurers in Portuguese Cathedral and Dutch Stadthouse, Singapore—the Lion City—with its past, remote and almost unknown, and all the opening possibilities of its future. It is only eighty years since it entered on its present phase of British settlement and free port owing to the prescient wisdom of Sir Stamford Raffles, and his co-adjutor Colonel Farquhar. In these eighty years Singapore has become the eighth port in the world for the volume of its trade. Raffles, however, aimed at more than the establishment of a port at Singapore; his further aim was to have had a sister port at Acheen in Sumatra, and thus have handed over to his country the guardianship of the gate of the Eastern Ocean, so that it might ever be open for the benefit of "such as pass upon the seas on their lawful occasions." One of the most charming features of this book is the tribute paid to this same Sir S. Raffles, that almost forgotten Founder of Empire, "who never exalted himself nor depreciated others." His very burial-place is unknown to us, but his living character is brought before us in the extracts from the *Hikayat Abdullah*, the fresh and simply-written book of his Malay protégé, Abdullah.

But the main part of the volume concerns the progress made by what are called the Federated Malay States, namely, Pérak, Selángor, the Nēgri Sēmbilan or Nine States, and the eastern state of Pahang. These native states are under the protection of the British Government, though not forming a constituent part of the British Empire. The record of their progress and of the benefits thus conferred on humanity must fill every Briton with pride and gratitude. The story of it is told by Sir F. Swettenham—himself a Governor of the Straits Colony and High Commissioner for the Federated States—with great lucidity and modesty. It almost transcends belief to read how a handful of our countrymen, led by a few so-called Residents at the Courts of the Malay Sultans, unsupported by any diplomatic, political or military power, have, with the welcome aid of Chinese energy and industry, altered the face of the whole country. The problem and its solution are briefly indicated in the following sentences.

"If I have been able to give the reader an intelligible idea of this waste of jungles and swamps, of mountains and rivers, sparsely inhabited by a far from industrious or happy people, preying on each other and on the heaven-sent Chinese toiler in an atmosphere of eternal heat, tempered by frequent deluges of tropical rain; if I have been able to show him something of the extraordinary change which has passed over the country and the people, lighting the dark places, bringing freedom and comfort and happiness to the greatly oppressed, and wealth to the greatly industrious; if now the reader sees a country covered with towns and villages, with roads and railways, with an enormously increased population, with every signs of advancement and prosperity, and if he also understands, in a measure at least, how this change has been brought about, I will cease to trouble him with further details of this unique experiment in administration."

But the details of the unwearied "spade-work" necessary are full of stimulus, and for them the reader must be referred to the volume itself.

The map and illustrations are excellent. In addition to the absorbing political interest there is a suggestive chapter on the character of the Malays, their customs, arts, literature, and their "parabolic" or "proverbial" wisdom.

POLAR.

The Norwegian North Polar Expedition, Scientific Results. Edited by FRIDTJOF NANSEN. Vol. V. Published by the F. Nansen Fund for the Advancement of Science. London: Longmans, Green and Co., 1906.

This volume contains a paper on the Bottom Deposits of the North Polar Sea by O. B. Boggild. The chief point brought out is the great uniformity of the deposits, due to the absence of land ice in the North Polar basin. Not a single mineral particle was found over 2 mm. in diameter; and of those present none were derived from volcanic rocks. Sixteen samples in all were obtained, most were shallow water deposits from off the Siberian coast; a few of grey deep-sea clay differing only from the former in being of a rather finer consistency. The absence of rocks in the shallow water deposits makes it probable that there are no projecting rocks above the surface and that there has been little, if any, elevation of the sea-bottom in recent geological periods. The deep-sea clays showed a remarkable paucity of organic constituents, doubtless because the surface of the ocean is for the greater part of the year entirely ice-covered. The foraminifera never reached 5 per cent. and siliceous organisms were entirely absent.

Separate appendices deal with the chemical analyses of the deposits and with the Thalamophora (Foraminifera) from the deposits and from the mud of ice-floes.

The greater part of the volume is taken up with an investigation of "Dead-Water" by V. W. Ekman. This phenomenon was met with by the *Fram* off Taimur Island and is frequently experienced in some of the Norwegian Fjords.

Sailing ships, slow steamers, or boats in tow suddenly lose way and refuse to answer the helm. This occurs where a layer of fresh or brackish water is present on top of the salt water. The author quotes a number of recorded instances and has done some excellent experimental work with boat models in a tank containing layers of water of different specific gravity. He makes it clear that a vessel moving at low speed generates large waves (well shown in photographs) at the boundary between the fresh and salt water, and that the propelling force is dissipated in their generation. Steering way is lost because the rudder is largely in a thickened layer of forward-moving fresh water. At higher speeds (varying with the depth of the fresh water layer and difference in density between the

two layers) these boundary waves are not produced and "Dead-Water" will not trouble the navigator.

The last paper is one by Nansen on the Protozoa from the pools which formed on the surface of the ice-floes in summer. These were in all probability marine iz-prigin, the germs being frozen into the ice when it formed, and development taking place with the summer thaw; they flourished in water which had only 1 to 2 per cent. NaCl along with numerous marine diatoms and other algae.

The protozoa were chiefly Infusoria, but some belonged to the Flagellata.

Numerous drawings made at the time of collection are reproduced, but circumstances did not permit of the full life-history of the organisms being made out nor were they specifically determined.

BOOKS RECEIVED.

Life by the Seashore: An Introduction to Natural History. By MARION NEWBIGIN, D.Sc. (Lond.) With many original Illustrations by FLORENCE NEWBIGIN. Cr. 8vo. Pp. viii + 344. Price 2s. 6d. net. Swan Sonnenschein and Co., Ltd., London, 1907.

On the Trail of the Immigrant. By EDWARD A. STEINER. Demy 8vo. Pp. 375. Price \$1.50 net. Fleming H. Revell, New York, 1907.

A Mission in China. By W. E. SOOTHILL. Demy 8vo. Pp. xii + 293. Price 5s. net. Oliphant Anderson and Ferrier, Edinburgh, 1907.

Our Own Islands: An Elementary Study in Geography. By H. J. MACKINDER, M.A. Cr. 8vo. Pp. xv. + 298. Price 2s. 6d. net. George Philip and Son, Ltd., London, E.C.

Handbook of Polar Discoveries. By A. W. GREELY, Major-General United States Army. Third Edition. Cr. 8vo. Pp. xii + 325. Little, Brown and Co., Boston, 1907.

The Egyptian Sudan. By J. KELLY GIFFEN, D.D. Illustrated. Cr. 8vo. Pp. 252. Price 3s. 6d. net. Third Edition. Fleming H. Revell, New York, 1907.

Highways and Byways of the Mississippi Valley. Written and illustrated by CLIFTON JOHNSON. Demy 8vo. Pp. xiv + 287. Price 8s. 6d. net. The Macmillan Co., New York, 1906.

Three Vagabonds in Friesland with a Yacht and Camera. By H. F. TOMALIN. With Photographic Pictures by ARTHUR MARSHALL, A.R.I.B.A., F.R.P.S. 4to. Pp. xii + 229 + xxvi. Price 7s. 6d. net. Simpkin, Marshall and Co., London, 1907.

Die Halbinsel des Sinai in ihrer Bedeutung nach Erdkunde und Geschichte auf Grund eigener Forschung an Ort und Stelle. Dargestellt von Professor Dr. E. DAGOBERT SCHOENFELD. Demy 8vo. Pp. viii + 196. Preis M.8. Dietrich Reimer (Ernst Vohsen), Berlin, 1907.

Du Niger au Golfe de Guinée par le pays de Kong et le Mossi. Par le Capitain BINGER (1887-1889). Two Volumes. Hachette et Cie., Paris 1892. (Presented by Colonel P. DURHAM TROTTER.)

A Junior Course of Comparative Geography, consisting of Course A: of "A Progressive Course of Comparative Geography." By P. H. L'ESTRANGE, B.A. With 140 Pictures and Diagrams. Demy 8vo. Pp. viii + 239. Price 2s. 6d. net. George Philip and Son, Ltd., London, 1907.

Lehrbuch der Ewe-Sprache in Togo (Anglo-Dialekt), von A. SEIDEL. Pp. 176.

The Hausa Language: Grammar (in English) and Systematic Vocabulary: (Hausa-German-French-English). Von A. SEIDEL. Pp. 292. Julius Gross, Verlag, Heidelberg, 1906.

Japanese Rule in Formosa. By YOSABURO TAKEKOSHI, with Preface by Baron SHIMPEI GOTO. Translated by GEORGE BRAITHWAITE. Illustrated. Demy 8vo. Pp. xv+342. Price 10s. 6d. net. Longmans and Co., London, 1907.

British North America: The Far West, the Home of the Salish and Déné. By C. HILL TROUT. (Native Races of the British Empire Series.) Demy 8vo. Pp. xiv+263. Price 6s. net. Archibald Constable, London, 1907.

Also the following Reports, etc.:—

General Handbook for Rhodesia. Pp. 66. British South Africa Co., London, 1907.

Illustrated Handbook of North-Eastern Rhodesia. Pp. 35. "Administration Press," Fort Jameson, 1906.

Winter in Schweden. Wegweiser des Schwedischen Touristenvereines. Pp. 48. Wahlström and Widstrand, Stockholm, 1906.

Summary Report of the Geological Survey Department of Canada for 1905 and 1906.

Geological Survey of Canada. Section of Mines. Annual Report for 1904. Ottawa, 1906.

Western Australian Year-Book, 1902-1904. (Thirteenth Edition). By MALCOLM A. C. FRASER, F.R.G.S., F.S.S., F.R.C. Inst. Pp. x+1283. Perth, W.A., 1906.

Administration Report of the Marine Survey of India for 1905-1906. Bombay, 1906.

Report on the Administration of the Civil and Military Station of Bangalore for the year 1905-1906. By The Hon. Mr. STUART FRASER, I.C.S., C.I.E. Bangalore, 1906.

Report on the Administration of Coorg for the year 1905-1906. Mercara, 1906.

Zur Wirtschafts- und Siedlungs-Geographie von Ober-Burma und den Nördlichen Shan-Staaten. Von Dr. HANS J. WEHRLI. Pp. 130. Zürich, 1906.

Monism? Thoughts suggested by Professor Haeckel's book "The Riddle of the Universe." By S. PH. MARCUS, M.D. Translated by R. W. FELKIN, M.D., F.R.S.E. Pp. 144. Price 1s. net. Pebman, Ltd., London, 1907.

General Report on the Operations of the Survey of India during 1904-5. Prepared under the direction of Colonel F. B. LONGE, R.E. Calcutta, 1906.

Ceylon in 1903-1905, describing the Progress of the Island since 1803: its present Agricultural and Commercial Enterprise, with useful Statistical Information. By JOHN FERGUSON, C.M.G. Demy 8vo, pp. xl+158+clxxxvi+27.

The Ceylon Rubber Exhibition, 1906. Lectures and Discussions on Rubber Cultivation and Preparation (Illustrated). Pp. 130.

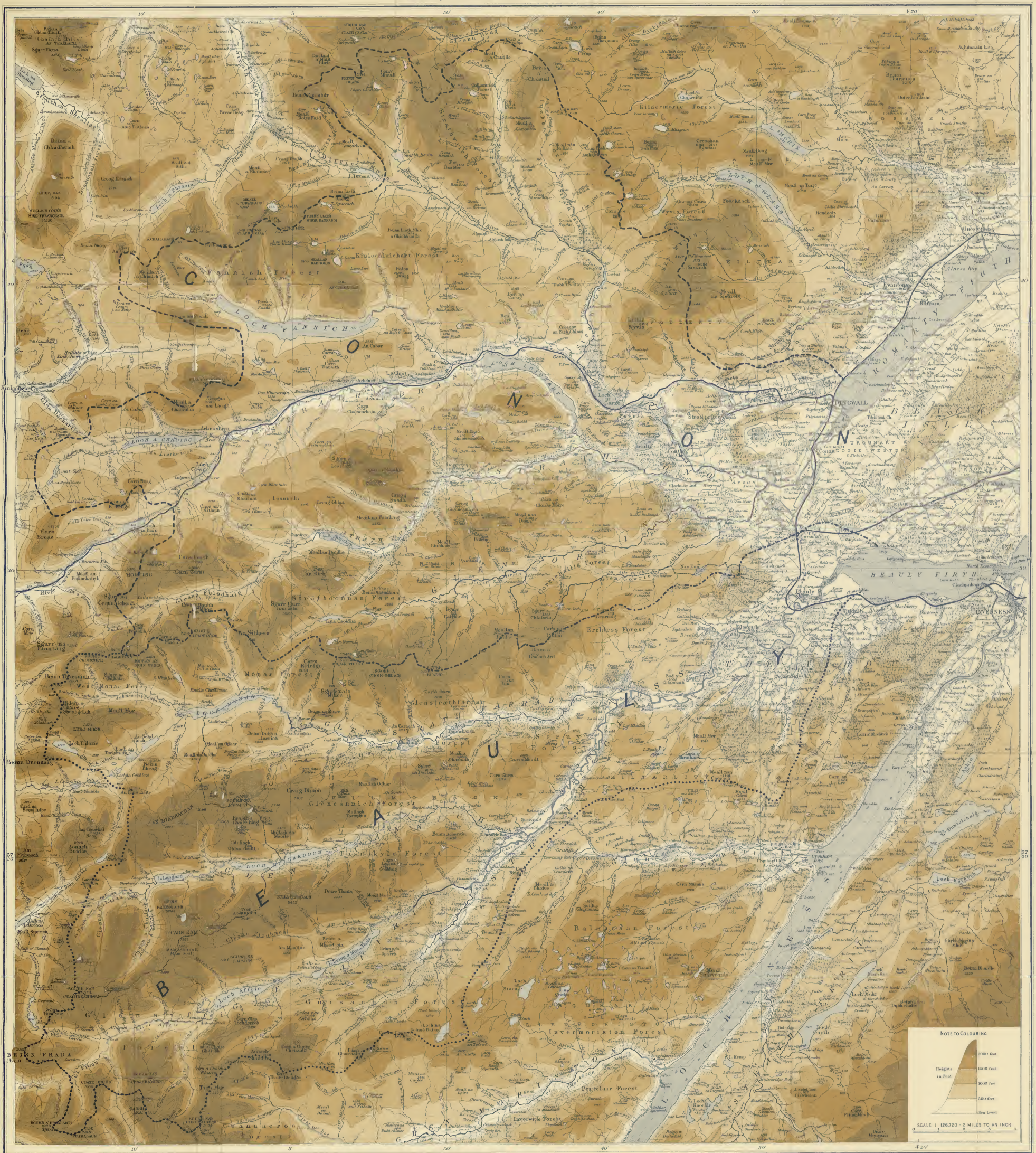
The Ceylon Handbook and Directory and Compendium of Useful Information for 1906-1907. Compiled and edited under the direction of J. FERGUSON, C.M.G., M.L.C. Pp. xxxviii+1411.

Presidential Address delivered before the Ceylon Branch of the Royal Asiatic Society. By the Hon. J. FERGUSON, C.M.G. Pp. 38. A. M. and J. Ferguson, Colombo, 1906.

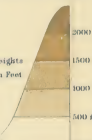
Publishers forwarding books for review will greatly oblige by marking the price in clear figures, especially in the case of foreign books.

MAP OF CONON AND BEAULY BASINS

ILLUSTRATING MR HINXMAN'S PAPER



NOTE TO COLOURING



SCALE 1 INCH = 2 MILES TO AN INCH

THE SCOTTISH GEOGRAPHICAL MAGAZINE.

THE SWISS VALAIS: A STUDY IN REGIONAL GEOGRAPHY.

By MARION I. NEWBIGIN, D.Sc. (Lond.).

(*With Maps and Illustrations.*)

(*Continued from page 192.*)

THE WOODS OF THE VALAIS.

The Arolla pine.—But even at the high levels the larch has not matters all its own way, for there it comes into competition with the 'hird important conifer of the Valais, the Arolla pine. In the Valais, and especially in the vicinity of the Monte Rosa *massif*, the Arolla pine occurs at the tree-limit, sometimes mingled with larch and sometimes forming unmixed woods of considerable extent. Like the larch, it sometimes ascends as more or less scattered trees up to over 2400 metres (7874 ft.) and forms woods even above the 2300 metre line (7546 ft.). It does not, however, descend as low as the larch, being much less tolerant of high temperatures. Where larch and pine occur in the same locality the pine ascends higher than the larch. The lowest point to which the Arolla pine descends in the Valais is 1500 metres (4921 ft.) at Lac Champex. It thus can hardly be said to compete with the spruce, for it does not as a rule flourish till levels when the spruce is beginning to feel the effects of the low temperature. On the other hand, the competition of the spruce drives the larch up to the region favoured by the Arolla pine, and in consequence either of this or of climatic changes *Pinus cembra* is gradually losing its hold, and is certainly a dying species. In the Arolla valley itself the trees are few in number, are in many cases in a dying state, and young trees to take the place of the old are conspicuously absent.

Spruce and larch are familiar to all, but it may be well to point out some of the characters of the less familiar Arolla pine. The needles,

instead of growing in bunches of two like those of our familiar Scotch fir, are many in each cluster, the seeds are devoid of a "wing," and are large and edible, being prized as food by man, by squirrels and other rodents, and by birds, notably the nutcracker, which is said to live largely upon them in Siberia, and may be seen at Arolla constantly engaged in tearing the cones to pieces with its powerful bill. In the Alps as a rule only relatively few cones are produced, but about once in ten years the harvest is exceptionally abundant. The toll taken by man, bird and beast is, however, so heavy that there can be no doubt that one reason for the gradual disappearance of the tree is that very few seeds are allowed to germinate. In itself this is not, however, a sufficient reason, for the tree is more fruitful in Siberia, and its comparative barrenness in the Alps can only be the result of unfavourable conditions of life.

The distribution of the Arolla pine is remarkable in that the area occupied by it in the Alps is small as compared with the vast tract which it occupies in Asia. Its abundance in Siberia has indeed given it the name of Siberian cedar. In Central Europe it occupies disconnected areas in the Alps and Carpathians, where its range nearly corresponds with that of the larch. The fact that the areas are disconnected would to the student of distribution at once suggest that it is an old type, and in point of fact there is abundant evidence to prove that *Pinus cembra* had once a much more extended distribution in Europe. In brief, it is one of the relics of the glacial period, and its progressive disappearance before and during the human period is to be regarded as due to that series of changes of climate which in Scotland, for example, is leading to the weathering and destruction of the peat deposits laid down under other conditions of climate (cf. Mr. Lewis's paper, *S.G.M.*, xxii. p. 241).

It has been already pointed out that the larch is a tree adapted to a continental climate, but this is true to an even greater extent of the Arolla pine. It is physiologically fitted for a long severe winter and a sudden hot summer. According to Simony, a locality where the mean temperature of May is 7°C . is as unfavourable as one where the mean summer temperature is less than 8°C . A frost-free period of sixty-seven days is sufficient, but the temperature during that period must be considerable. According to Simony, in the Alps the isotherms of 0° and 5°C . mark its upward and lower limits. But even more than conditions of temperature is its extension limited by conditions of moisture. It is the physiological relic of a period when the air was loaded with moisture, and in the Alps it approaches the glaciers because their damp breath is like a reminiscence of an earlier time. It also favours a clay soil or a soil containing humus because of the power which each displays of holding water. Further, in that in the Alps it is the westerly winds which bring moisture, we find that westerly exposures are much more favourable than easterly ones. Thus on a valley wall facing south-west the tree will on the average ascend more than 300 metres (984 ft.) higher than on a slope in the same region facing south-east. In this case the upward extension on the south-west slope is due to the favourable conditions of warmth, and the lower to the favourable conditions of moisture.

In regard to physiology there are many interesting points, all tending to emphasise the primitive nature of the tree. Thus growth is extraordinarily slow—like the elephant the Arolla pine belongs to a period when time was of no consequence. The normal length of life is 350 to 400 years, and exceptionally trees may live 600 to 800 years. Reproduction does not take place until the tree is sixty years old, and in the Alps, as already mentioned, cones are abundant only about once in ten years. The seedlings are shade-loving, and grow much more slowly than those of the spruce. Thus it takes ten years for them to reach a height of half a metre ($1\frac{1}{2}$ ft.), and at eighty years, when the larch has reached a height of 30 metres (98 ft.), and the spruce about 22 metres (72 ft.), the Arolla pine is only about 8 metres (26 ft.) high. The seedlings can only thrive where there is undergrowth to shield them in the early part of their life, and this fact naturally limits the upward extension of the tree. To all the natural disadvantages which limit the spread of the tree, one must add that its close-textured wood is valuable, so that in the Alps man long since joined the already lengthy list of its enemies. The wood is strongly impregnated with resin, and in consequence decays very slowly. One result of this is that, under natural conditions, dead trunks may stand for a long period before they fall. It is the presence of such dead trunks in regions where there are no young trees that is one of the proofs of the former extension of the Arolla pine in the Alps. Almost everywhere in the Alps it is possible to demonstrate by this and other means that the area is constantly diminishing. In short the Arolla pine, even less than the larch, cannot effectively contest the supremacy of the spruce in the Valais. The pine, indeed, on account of the unfavourable north-eastern exposure of the northern valleys, is for the most part limited to the lateral valleys to the south of the Rhone, and is only abundant about the Monte Rosa group. The accompanying table sums up the characters and distribution of the three trees mentioned:—

SUMMARY TABLE FOR SPRUCE, LARCH, AND AROLLA PINE.

Tree.	Limit of Temperature.	Maximum elevation reached.	Height of Tree.		First Flowering.	Remarks.
			At 10 yrs.	At 80 yrs.		
Spruce, .	+1.6° C.	2000-2100 m.	$1\frac{1}{4}$ - $1\frac{1}{2}$ m.	22 m.	30-40 yrs.	Moisture in air or soil essential.
Larch, .	-1° C.	2300-2400 m.	4 m.	30 m.	15-20 yrs.	Full exposure to sun essential.
Pine, .	0.0° C.	2300-2400 m.	5 m.	8-9 m.	60 yrs.	Large amount of moisture in air or soil essential.

The heights are given in metres, and the temperature is the lowest mean annual the tree can tolerate.

Of the other conifers which occur in the Valais, it is only necessary to mention in passing the mountain pine (*Pinus montana*), which is infrequent, but sometimes forms pure cultures, as, for example, at Grächen in the Saas valley. Here it occurs in its upright form, the curious dwarf form which is common in Austria at the tree-limit being uncommon in Switzerland. As already mentioned, the Scotch fir (*Pinus sylvestris*) is somewhat uncommon as a forest-former. It occurs on the floor of the Rhone valley, where the soil has the necessary arenaceous character, and also sometimes on moraines. It does not, according to Christ, ascend above 1500 metres (4921 ft.).

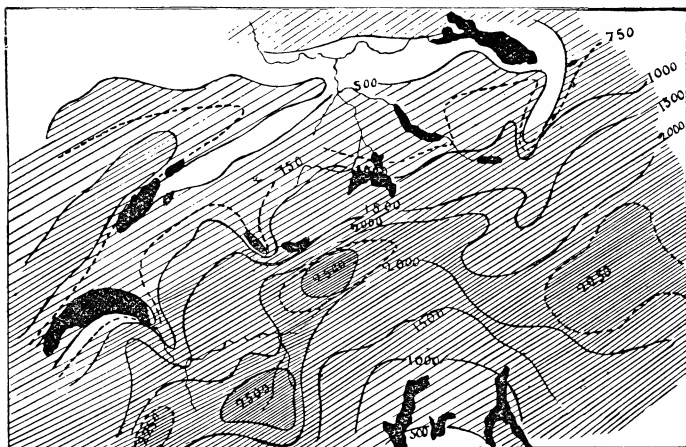
A short note on the actual conditions in certain valleys may serve to make the foregoing general description more vivid. Take, for example, the Val de Bagnes. For much of its extent the sides of this valley are luxuriantly clothed with spruce. The highest village is Fionnay (really a *mayen* and not a village), which stands at an elevation of 1497 metres (4910 ft.: cf. figure on p. 188). Round the little group of houses and hotels fir-woods are abundant, and mixed with the dominant species, especially at the margin of the torrent, at the edges of clearings, or generally in places unsuited to the spruce, the larch occurs. Walking up the valley from Fionnay, it will be found that the spruce persists until one has ascended a vertical height of about 100 metres (328 ft.), but at a height of some 1590 metres (5116 ft.) it is replaced to a large extent by larch. The transition between the two types of wood is very striking here, and it is interesting to see how the few remaining spruces seem to seek shelter beneath the taller larches. In the region where the spruce is dominant the surface of the ground is *either* covered with pasture-land *or* with forest, but in the larch region the grass flourishes beneath the sparsely scattered trees, thus giving a combination of wood and pasture which is rarely seen in Switzerland.

On continuing up the valley, we find that the last larches, which are also the last trees, are seen near the inn at Mauvoisin at a height of about 1800 metres, the valley above being narrow and almost sunless even in midsummer. Lower down the valley trees ascend about 200 metres (or 656 ft.) higher, but here the valley is wider, and therefore more fully exposed to the sun. Generally, we may say of the Val de Bagnes that the tree-limit varies from 1800 to 2000 metres (5905 to 6562 ft.) according to the exposure, and larches form the limiting form, the Arolla pine being absent.

If the traveller continue his journey to the head of the valley, and then cross one of the glacier passes to Arolla, he will find that while he left behind the last tree at 1800 metres (5905 ft.), he finds the first trees in the Arolla valley at from 2200 to 2300 metres (7218 to 7546 ft.), that is, about 400 to 500 metres (1300 to 1640 ft.) higher up. Further, while in the valley which he has left behind the larch formed the tree-limit, the first trees which he encounters here are Arolla pines. This fact the guide-books do not fail to emphasise; but the traveller who, stimulated by Baedeker, looks forward with interest to seeing this tree, will be greatly disappointed when his eyes fall upon the aged and decrepit trunks which surround the hotels, and are outlined against that dreary

waste of stone which is the chief feature of the Combe d'Arolla. Let him continue his journey over to Zermatt and he will find there, at an elevation of 2300 metres or more, fine and flourishing woods of Arolla pines, which constitute indeed one of the great beauties of the valley. As other series of valleys would give similar results, we are justified in saying briefly that the tree-limit rises as the Zermatt region is approached, and that where the limit is high the Arolla pine forms the limiting species; where it is low this species tends to be absent. We have seen above that the zone of cultivation also rises as the Zermatt region is approached.

The explanation has been so clearly set forth in a series of recent



Mean elevation of the surface of Switzerland. (From de Quervain after Liez.)

German papers that it can be given very briefly, the more briefly as the results of these papers are expressed in maps which we reproduce here.

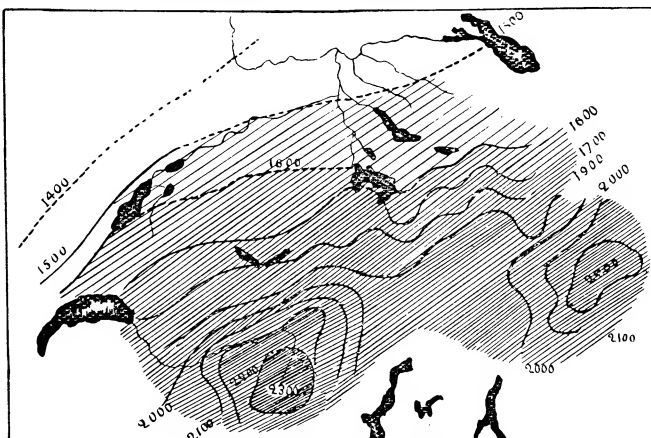
In the first place, a paper on the mean elevation of Switzerland, by H. Liez,¹ shows that the greater part of the Valais has a mean elevation of over 2000 metres (6562 ft.), and a considerable area in the vicinity of the Monte Rosa group, a mean elevation of over 2500 metres (8202 ft.). Comparing with this the results obtained by J. Jegerlehner,² in a study of the snowline, we find that this line rises highest (3200 metres or 10,499 ft.) in the region of the greatest mean elevation, while Ed. Imhof³ has shown that the same thing is true of the tree limit, which is highest in the Monte Rosa region, the region of greatest mean elevation, and next highest in the Engadine, where the mean elevation is almost

¹ "Die Verteilung der mittleren Höhe in der Schweiz."—*Jahresbericht d. Geographischen Gesellschaft von Bern*, xviii. (1903).

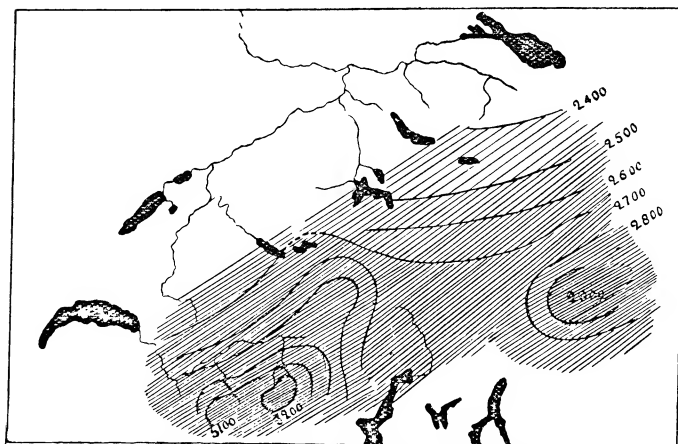
² *Beiträge z. Geophysik*, v. (1901-2).

³ "Die Waldgrenze in d. Schweiz," *T. cit.* iv. (1899-90).

as great. As throughout Switzerland it can be shown that the snowline and the tree-limit vary together, the distance between them remaining



Isohypes of tree-limit. (From de Quervain after Imhof.)

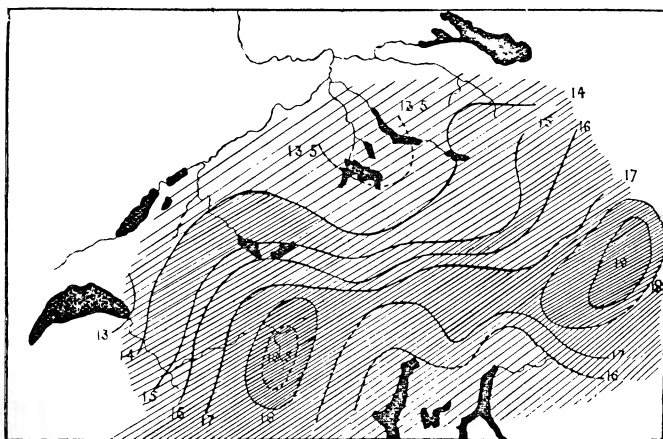


Isohypes of snowline. (From de Quervain after Jegerlehner.)

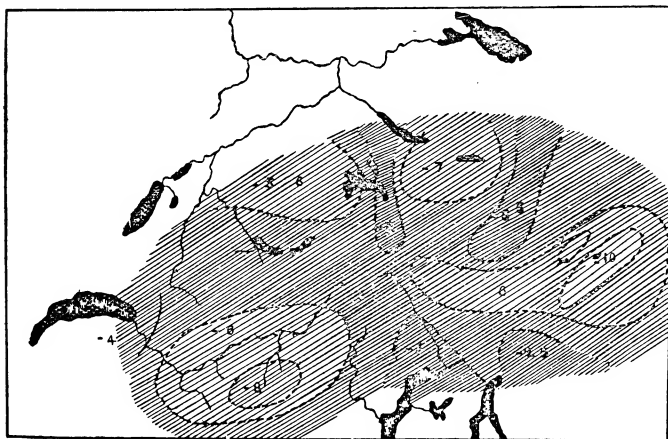
approximately constant, it is reasonable to suppose that both are determined by a similar cause, which has been shown by A. de Quervain¹ to

¹ "Die Hebung d. atmosphärischen Isothermen in d. Schweizer Alpen u. ihrer Beziehung z. d. Höhengrenzen."—*T. cit.*, vi. (1903-4).

be the special conditions of temperature which exist in regions of great mean elevation. This author has taken the daily temperature readings at



Isotherms at a height of 1500 m., July, 1 P.M. (From de Quervain.)



Isotherms at a height of 1500 m., Jan., 7 A.M. (From de Quervain.)

7 A.M. and 1 P.M. for a large number of stations of different altitudes throughout the year for a ten years' period, and after reducing the temperatures to a mean level of 1500 metres (4921 ft.) has plotted the results in the form of a series of isotherms on the map of Switzerland.

Two of these maps are reproduced here. The result is to show that, owing to the conditions of radiation, etc., which exist in mountain regions, the temperature at midday is considerably greater in regions of great mean elevation than in regions of lower mean elevation, throughout the greater part of the year. In other words, a place in the Zermatt region, or in the Engadine, at an elevation of 1500 metres, would have at midday a considerably higher temperature than a place of the same elevation in the Canton Ticino, or one in the vicinity of Lake Geneva. This statement is true for all the months from February to November, but not in January and December. The amount of the difference varies with the season, being greatest (5.5°) in July and least in February (3.5°). On the other hand, at seven o'clock in the morning the elevation of the isotherms is much less conspicuous even in the warmer months, and in the colder months there is then a depression of the isotherms at great elevations (cf. map p. 231). That is, at seven o'clock on a January morning a place in the Nicolaithal would be considerably colder than one of corresponding elevation in the lowlands. As it is the midday temperature which specially counts in the life of plants, and in the melting of snow, the results obtained by de Quervain, explain the elevation of both the snowline and the tree-limit in the Valais. The causation of the elevation of the isotherms on approaching the great mountain masses is the conditions of radiation which exist there as compared with those existing in regions of less mean elevation.

In the Alps of the Valais generally a vertical distance of about 890 metres separates the snowline from the tree-limit, but it is rather interesting to note that in Val de Bagnes the two are separated by a vertical distance of 1000 metres (or 3281 ft.). The reason, as de Quervain points out, is to be sought in the shape of the valley. The mountains reach a considerable elevation (Grand Combin, 4317 metres, or 14,164 ft.), but the valleys are deep narrow gorges, whose walls, as in the vicinity of Mauvoisin, may shut out the sun save for a short period of the day. The elevation of the mountains raises the snowline, but the shape of the valley lowers the tree-limit, hence the unusual distance between the two here, and hence also the absence of suitable ground for the Arolla pine.

III.—THE ALPS OF THE VALAIS.

We have finally to consider that most important part of the Valaisian area, the Alps or high pastures. From all that has been said already of climate, elevation and natural productions, it is obvious that the possibilities of cultivation in the region must be strictly limited. The flat floor of the Rhone valley with its constant liability to inundation, the lower terraced slopes of the main valley, and parts of the larger lateral valleys, constitute the whole available area, and even so cultivation in the higher parts is beset with many difficulties. The mineral products of the region are insignificant, manufactures almost absent, and yet the canton in 1904 had an estimated population of

116,843¹ persons, giving a density of 56 per square mile as contrasted with a density of 11 for Sutherland, and 21 for Inverness. Further, the population is increasing, the estimate for 1904 showing an increase of 2 per cent. on the 1900 figures. This obviously means some source of wealth which has not been yet considered, and though we must not forget the "tourist industry," yet the great source of wealth in the canton is certainly the cow.

If we may take the sheep as a symbol for the Scottish Highlands, then the cow may serve as a fitting symbol for the Valais, as for much of Switzerland. The development of the dairying industry again depends upon the abundant growth of grass in the alps.

It would be a matter of great interest, as illustrating the inter-relations of history and geography, to trace in the case of the hill-folk of Switzerland and the Highlands the relation of the mental and moral qualities to the occupation. For that this is not the place, but in passing we may just note that in both cases the open life on the mountains with the flocks has bred an unconquerable love of freedom and independence, and a warrior spirit, which has time and again left its mark on the pages of history. Our language is deeply impressed with the Oriental imagery which makes the shepherd the type of gentleness, but in point of fact the herd's life, with its perpetual conflict with nature, does not, among the Westerns at least, produce such a spirit.

Again, no doubt because of the constant contact with the forces of nature, alike in Switzerland and in Scotland, the people of the hills are profoundly and typically religious. This attribute expresses itself in different forms it is true, but even the most confirmed Protestant can hardly fail to be touched by those crude religious emblems which are dotted over the Swiss hills, and which, hardly less than the churches of the Scottish Highlands, suggest the connection between the pastoral life and strong religious instinct.

Leaving aside those sociological points, it is necessary to consider in detail what exactly an alp is. In the list of the zones of vegetation in the Valais given above, the third or alpine zone was stated to be that between the tree-limit and the snowline. Very little reflection will, however, make it clear that over a large proportion of this area the vegetation is not sufficiently great in amount to form a pasturage. Great expanses of the surface are covered by moraines or by screes and rock-rubbish, and other regions are precipitous, and devoid of any covering of soil. Thus the alpine region is the region in which the high pastures occur, but not the region in which the surface is predominantly pasturage. Again, nimble as the Swiss cow is, there is a limit to its agility, and therefore, although the pasturages are by no means, as the stranger is apt to assume, level areas, there are necessarily regions of moderate gradient. What, then, are these grass-covered regions which occur throughout the high ground of Switzerland? Roughly speaking, the alps are mountain shelves bordering the valleys, and these shelves form pasturages because they mark the sites of the old glaciers and are

¹ *Statesman's Year Book*, 1906.

thus covered with morainic matter, which forms a fertile soil. The accompanying three sections across parts of the Val de Bagnes show the exact position of the alps. It will be noted that the valley in which the present torrent flows becomes increasingly gorge-like as one ascends the valley,

FIG. 1.

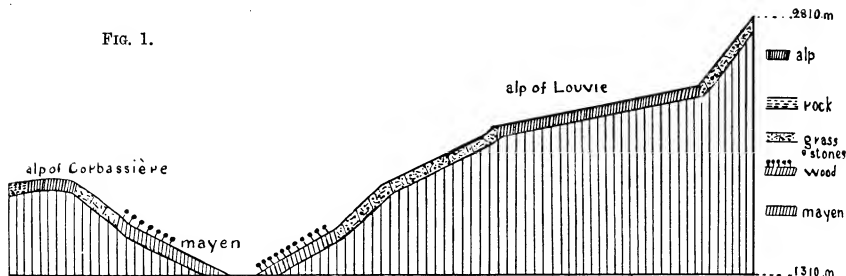


FIG. 2.

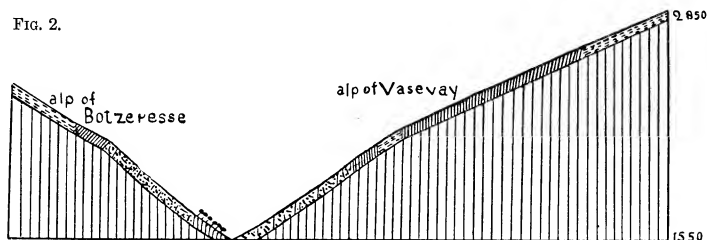
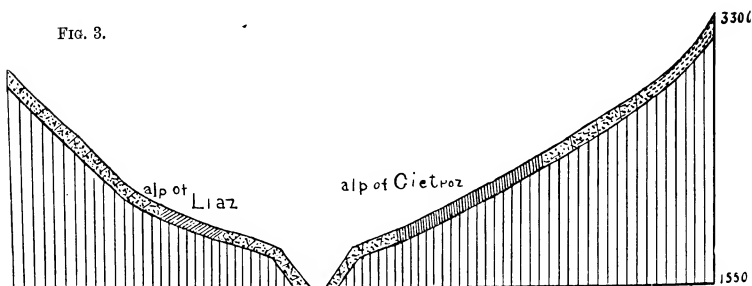


FIG. 3.



Sections across the Val de Bagnes, to show the position of the alps. The horizontal and vertical scales are the same.

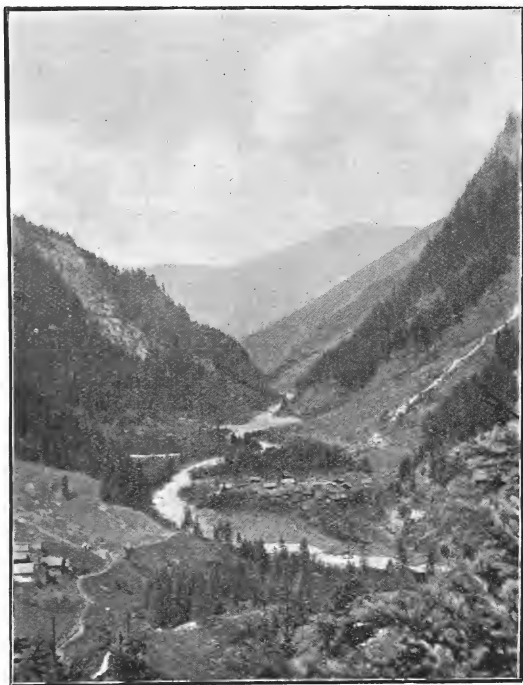
but whatever the shape of the existing valley, there is clearly shown at either side the platform which marks the remains of the bed of the old glacier, and here the alp is situated. Thus, in climbing the side of the valley one has first a very steep rise from the valley floor, then a gentle slope—the alp, which ends suddenly (Fig. 1) or gradually

(Figs. 2 and 3) against the base of the great peaks. Fig. 3¹ is taken above the level at which trees occur in the Val de Bagnes, but Fig. 1 is of great interest as showing the position of the woods relative to the alps, and the position of what are known as the mayens. Where the first part of the valley wall has a considerable slope, but is not absolutely precipitous, it is usually clothed with trees. Where the slope is gentle, as especially happens where a lateral stream has formed a considerable cone, then there is a more or less considerable stretch of pasturage, carefully fenced in (see illustration p. 236). It is here that the cattle come in spring while the snow is still on the upper pasturages. When they are driven to the high ground in the middle of June, the grass is allowed to grow again, and by the earlier part of August it is cut as hay, to be stored for use in late autumn or winter. Between forest and mayen, as the figures suggest, there is a certain amount of rivalry as it were, and it is to extend these early pasturages that in parts of Switzerland excessive forest destruction has gone on. The mayen forms a transition between the cultivated land and the alp, and the fact that it is less difficult of access than the alp makes it possible to cut and store its grass as hay. The alp, if one may put the matter so, is so difficult of access that its produce must be transported in the compact form of cheese.

One other point, both mayen and alp have been made by the denuding action of ice and water—we need not stop here to discuss the relative action of the two—but these forces are also their great enemies. Both alp and mayen are bounded above by steep slopes, and that in a region where ærial denudation is extraordinarily rapid. Both are in consequence in constant risk of being overwhelmed by avalanches of stones and mud, while as the glaciers advance and retreat their moraines may be pushed over fertile stretches of pasturage. In other words, the forces which made the pasturages are still in action. Again, the position of the alps is such that they are naturally traversed by streams of water from the heights above, such streams being of all dimensions. The soil of the alp is never very thick, but the dense covering of grass and herbage protects it from the denuding action of the small runnels so long as it is intact. If, however, the pasturages are badly managed and allowed to be overcrowded, then the covering may be completely destroyed, the dark soil beneath is exposed and is soon channelled and carried away. In the Val de Bagnes the cows are milked on the alp, and small areas of destroyed pasture of this kind were very obvious round the huts where the cows are collected for milking. The grass and alpine plants have here disappeared, and are replaced by a scanty covering of nettle, *Chenopodium*, dock and dandelion. Where such patches occur on the slope the soil is being rapidly washed away.

¹ It is interesting to note the resemblance between this section and the diagrammatic representation of an alpine valley given by Professor Kilian in an article on "Glacial Erosion and the Formation of Terraces," in *La Géographie*, xiv. 5, 1906. To this article reference should be made for an explanation of the causation of the peculiar shape of the valley. See also Penck's *Die Alpen im Eiszeitalter*.

In regard to the paths to the alps, a point which was very noticeable in the Val de Bagnes is worth mention in connection with the evolution of ways of communication. The valley is still unsophisticated, and therefore the paths are for the cows and not primarily for the tourists—there are no special tourists' paths. Now, wherever the gradient is steep the path is admirably marked, but no sooner does the ground become easy than the path dies away and is lost. The reason is obvious. When the ascent is steep the cows must necessarily keep together, and the path must be kept in repair; where it is easy each



Mayen du Revers, Val de Bagnes. The nuts are placed on a cone brought down by the lateral stream to the right. Note the gentle slope to the left which forms the mayen or spring pasturage. The trees are spruce, mingled with larch.

cow wanders off on a path of her own in search of some succulent herb, and the herdsman allows them to scatter until the approach of a steep region necessitates their collection. This is very striking in the path over the Col de Fenêtre, which is a mule-path according to the guide-books, but which in point of fact, in crossing the pasturage of Chermontane, simply disappears, though above and below it is well marked.

The plants of the alps.—We have thus seen that the alp is a relic of a past period of greater glaciation, and as its soil is thus the rock débris derived from the neighbouring mountains, there are naturally great differences in the fertility of the different alps. We must next consider the nature of the plants produced by the alps in order to learn wherein consists the value of a fertile alp. As compared with the more familiar conditions which exist in this country, the striking feature is that the grasses are relatively less important. In this country the chief fodder plants are the grasses and various Leguminosæ, especially the clovers. The reason is not primarily the special food value of these plants as compared with others, but the absence of strong distasteful odours, of much indigestible supporting tissue, and of poisonous extractives, etc. In Switzerland a very large number of plants are consumed as fodder, and of the three which are specially prized by the herdsmen as signs of fertility on an alp, only one is a grass. These three precious plants are *Poa alpina*, a grass which is not uncommon on the hills of Scotland, a plantain (*Plantago alpina*), and one of the Umbelliferae, *Meum mutellina* by name. A large number of grasses, Leguminosæ, Compositæ, and so on are also eaten, but relatively the grasses are less important than with us. Further, when valley grass or hay is compared with alpine hay or grass, it is found that the alpine plants are richer in proteids and fats, while they are poorer in cellulose than the valley forms. The reason is to be sought in the special conditions of existence of the mountain plants. As already explained, they are during the short growing period exposed to very strong insolation. The bright light checks growth, so that the plants tend to become tufted and short-stemmed. At the same time there is a slighter development of mechanical tissue, so that they are softer and less rigid. The result is that plants which the cattle will not eat or cannot digest on the low ground are sought after as food above. Again, it is well known that many alpine plants tend to reproduce themselves vegetatively rather than by seeds. The grass *Poa alpina*, for instance, in its viviparous variety, has leafy buds in place of flowers. Associated with the vegetative method of reproduction, and with the necessity of storing food for the long cold winter, there is a strong tendency to accumulate food-products in the leaves. We might perhaps sum up the differences by saying that the plants of the high alps have to concentrate into a period of about three months the whole of their activities, and that in consequence the growth there is richer but less voluminous than on the lower ground. Another point of view is to say that as only a few herbivores naturally inhabit the high alps, the plants of that locality do not need the means of protection necessary for plants growing at less elevations.

Whatever the immediate cause, the result, so far as man is concerned, may be realised by quoting from Anderegg's book¹ some figures for the alps of the Valais. There are in the canton 422 alps, which have a

¹ *Schweizerische Alpwirtschaft. Illustriertes Lehrbuch.* Von Professor Felix Anderegg. 3 Parts. Bern, 1899.

capital value of nearly £180,000 ($4\frac{1}{2}$ million francs) and yield a net profit of £28,000 (705,000 francs) per annum. This works out at nearly a pound per "kuhstoss" (*i.e.* the proportion of alp required for the keep of one cow during the sojourn on the alp). The figures, of course, include a number of young cattle, etc., which are not directly productive. Where cows in milk alone are considered it is found that the net profit obtained from each cow during its eighty-eight days' sojourn on the alp is about £2, 10s. (the actual figure is 62 francs; see Anderegg, ii. p. 507) in butter, milk, and cheese. In other words, every day spent on the alp by each cow brings a net profit of sevenpence to its owner. Owing to the difficulty of transport, due to the position of the alps, the milk is for the most part converted into cheese, the whey being given to the muscular-looking pigs which accompany the herd to the alps. As the cheese is not consumed on the alp, it is obvious that every summer the alp is losing more than is returned to it in the form of manure. How is this waste made up for? To some extent it is made up for by the system of irrigation which, as already mentioned, prevails in the Valais. The irrigation channels contain glacier water, or "glacier milk" as the Germans call it, which is simply loaded with glacier mud. The fine particles of this mud fertilise the soil in precisely the same fashion as the Nile mud fertilises Egypt. Again, even where systematic irrigation does not go on, denudation is proceeding so rapidly all round that the surface of the alps is in constant process of renewal. In this connection it will be remembered that, as the alps are geologically of recent origin, and consist of a vast number of kinds of rocks of very different hardness, rock waste is much more rapid than in an old land surface like the Highlands of Scotland, where the softer rocks have long since been worn away to form the Lowlands, and only the resistant forms remain.

It was pointed out in the early part of this paper that by far the most impressive way of entering the Valais is to cross the Gemmi pass, and gaze from its summit over the great cleft of the Rhone valley to the giant peaks of the Pennine Alps towering up to the sky. The foregoing account may serve to show that the instinct which draws the attention first to the mountain wall is geographically the right one, for almost every feature of the geography of the canton is determined by the mountains. It is the mountain ring which produces the warm, dry climate, while the glaciers supply the water necessary to make up for the deficient rainfall. Further, it is the scouring action of the glaciers which supplies the rock-floor upon which the whole fertility of the region depends. Even the catastrophes which often overwhelm not only pasturages but villages are in reality but part of the beneficent action by which nature perpetually fertilises anew the Alpine lands. The geographer who crosses the turbid Rhone on his homeward journey may carry his thought one step further and reflect that pasturages and mayens, even the great lake itself, are but temporary phenomena, but stages in the process by which the alps are in process of being ground down to a mere core like the Scottish Highlands. Meantime, however, whether from wholly geographical causes or not, there can be no doubt

that the Alpine regions benefit a proportionately much larger number of persons than do the Highlands. In the alps one sees man as, at least to some extent, the conqueror of nature, rather than as the conquered, as in the Highlands.

COSSACKS AND COSSACKDOM.

By V. DINGELSTEDT, Corr. Member of the R.S.G.S.

THE Cossacks have perhaps primarily an historical and political interest, for they have powerfully contributed to the extension and maintenance of the huge Russian Empire; but they possess also considerable interest for geographers and ethnographers, for they occupy an area more than double the size of that of the United Kingdom, their number equals that of the population of some independent states, and their ethnic composition is more complicated than that of many other nations.

The Cossacks are now attracting the particular attention of the civilised world; for, after having won for Russia immense territories, they are now actively employed in crushing the internal troubles, due to popular discontent and a desire for change in the political and social regime.

Literature about Cossacks is not abundant. There are many erroneous notions about them, and the author of the present article deems it useful to gather together what is known about them just at the present moment, when they are playing such a conspicuous part on the scene of contemporary history, and perhaps are on the point of undergoing themselves some important transformations in accordance with new popular tendencies incompatible with the existence of Cossackdom.

Cossacks are not a nation, nor a particular tribe nor race: they are a distinct and privileged part of the heterogeneous Russian population, a social body of soldier-husbandmen, a class (*soslovié*), an hereditary order (*confrérie*) with its own duties, rights, privileges, customs, manners and traditions. They are not governed by the common law, but by rules constituting a part of the military code. They are not burghers nor citizens, but militiamen, and their interests are not those of common Russian subjects.

Napoleon I. was strongly impressed by the deeds of the Cossacks; he prophesied that in a century Europe would be either republican or Cossack. It does not seem that the great leader proved himself a great prophet, but he did not certainly much err in attributing to Cossacks an eminent importance and value.

Let us cast a glance on the origin of Cossacks and their past prowess, before considering the territory they occupy, their divisions, their strength, occupations, customs, character, etc.

Name and origin.—The name of Cossack—Russian *Kosak*—has been variously derived from the Turkish *kazák*, meaning a robber, and other words in different languages signifying “an armed man,” “a sabre,” “a

rover," "a goat," "a cassock," etc. It was first heard of in the tenth century. Maçoudi calls them Kechek, and Nestor somewhat later gives them the name of Kassghar. For the Russian mind the name of Cossack conveys an idea of a free, rough, weather-beaten, and rather happy fellow. There is a Russian saying:—

"It is for that
The Cossack is so fat:
From sweet repast
To calm repose
He turns."

It is probable, however, that this description refers more to the past than the present state of Cossackdom, and gives a clue to its remote origin.

According to Scherer (*Annals of Russia Minor*) the first Cossacks were descended from Komans obliged to flee before the invasion of Tartars, who in 1272, under the leadership of Batu-khan, came to occupy the part of the empire left by Tchinghis-khan.

The Komans settled at first in the lower Yaik (Uralsk), but, later on, on the approach of Batu-khan, were forced to flee as far as the Dnieper and the Don, and take refuge in the caves, the islands and the marshes of the lower parts of these rivers. Hence they made their raids into the neighbouring states and enlisted all the roving and discontented elements, Tartars, Kalmucks, etc., for rapine and pillage. They gave origin to a number of hordes, some of whom, after many adventures, settled in the islands of the Dnieper below its falls, and thus formed the Zaporog Setch.

Zaporog Cossacks were the prototype of Cossacks. The world has never seen such an audacious, enterprising, and terrible band of military men, with proverbial courage. In order to obtain admission to their number, it was required from the candidate to profess the Greek faith, to be a bachelor, to pass in a boat against the current the thirteen cataracts of the Dnieper, to have killed ten of his enemies, to be an excellent shooter, to be able to swim across the Dnieper, and so on. Their chiefs were elected every year. They had almost everything in common, and they rigorously excluded women from their midst. About seventy thousand strong, they became a scourge to all their neighbours, a menace even for Russia at the time when Ataman Mazeppa made friendship with Charles XII., the king of Sweden. After the battle of Poltava, and later under Catherine II., they were partly dispersed and partly annihilated.

Two things were necessary for the extension of Cossack states—space and discontent; and both Russia and Poland in the sixteenth century had plenty of those gangs of adventurers, marauders, vagabonds, robbers, outcasts, cut-throats who, seeking freedom and fleeing from pursuit, were able to traverse badly delimited frontiers, and establish themselves on some masterless lands on the wooded banks of the Dnieper, the Don, Ural, etc.

These predatory gangs of malcontents could not fail to be organised

under the headship of more distinguished men. To their formation into more orderly communities further contributed Polish and Lithuanian-Russian lords, and later on the princes of Moscovia, who impressed on them the ideas of knighthood and the stamp of patriotism.

The Polish landlords obtained as a grant from their kings immense territories in the southern steppes of Russia, and, in order to people them, they promised to peasants willing to settle in these regions freedom from taxes and duties and impunity from any crimes they had committed. The measure proved successful, the formerly uninhabited steppes changed their aspect, they were peopled and opened to culture; the *stanitsas*, at first independent one from another, combined for the election of a common chief or *ataman* (hetman); and already in 1649 a daring Cossack chief on the Dnieper, Hetman Khmelnitsky, had succeeded in establishing a semi-autonomous state, at first allied to Poland and later transferring its allegiance to Russia (1654); other Cossack communities at the end of the fifteenth century, after the partition of the south-eastern steppes between Poland, Muscovia and Turkey, rose to considerable importance, acquired lands and rich booty, and were able to wage wars with all their neighbours, and especially the Moslems.

The Tsars of Moscow knew how to profit by the valour and audacity of these turbulent freelances; they supplied them with bread, powder and lead, granted them lands and privileges, addressed them compliments, recognised their liberties, and at the same time prepared the way for submitting them to their rule.

After Zaporog's *siez* of Cossacks, crushed and suppressed by Catherine II. (1792), the next great colony of Cossacks, and the most important one at the present day, was established in the middle of the sixteenth century, on the Don and Medvieditsa and the shores of the Azov Sea.

The first Don Cossacks *ataman* which history mentions, bore the Tartar name of Sariazman, but the colony consisted mainly of outlaws and fugitives, *rascolnick* (dissidents) and adventurers from Russia, and Poland, and the Crimea. In the second half of the same century these colonists had already succeeded in forming powerful and aggressive communities. Lately their number has considerably increased by Zaporog Cossacks, the people of Ukraine, runaways, brigands and adventurers from all eastern Europe, all willing to enter into the ranks of Cossacks in order to enjoy liberty and the adventurous life of freelances and marauders.

In 1570 the Don Cossacks asked for and received the protection of Ivan the Terrible, but his hand did not weigh heavy on them, and long afterwards they could repeat the saying: "The Tzar reigns in Moskov and the Cossack on the Don."

In 1580, under the leadership of Yermak, an absconded criminal, a gang of Don Cossacks conquered a part of Siberia and thus laid the foundation of the now important Siberian Cossacks' army.

The power and prosperity of the Don Cossacks only increased their turbulence and aggressive spirit, and Peter the Great found it necessary to subdue them; he crushed their revolt under Bulavin, reduced their territory, and forbade further recruiting of their ranks.

In the course of time the number and the importance of the Cossack settlements went on increasing. In order to push forward the frontiers of their domain the Russian princes did not want so much to wage great wars, as to wage small ones, in the Caucasus and in Central Asia, against Asiatic tribes, mostly divided among themselves. They wanted for that purpose not great regular armies, but armed, warlike, adventurous, vigilant populations, exactly such as these free-booters and daring adventurers who formed Cossackdom, and were recruited from the discontented elements of the nation, were capable of offering. The Cossacks constituted also an excellent distraction from internal troubles. Being compelled to defend their frontiers from the incursions of piratical tribes, and hoping to extend their domains at the first opportunity, the Russian princes, by granting lands and privileges, founded more and more Cossack colonies. Thus have been founded on the lower course of the Kuban the Tchernomorsky Cossack army, mainly from the remains of the Zaporogs; the Terek-Kislar Cossack army in the Northern Caucasus; the Grebenskoy Cossack army in the second half of the sixteenth century from the fugitives from the Don, after the punitive expedition of the *stolnic* Murashkin; the Mosdoc Cossack army, from the Cossacks settled at first on the Volga and the Khoper, and others. The cordon line of Cossack settlements went on continually increasing from the Sea of Azov to the Caspian, and from the Caspian along the Ural across Orenburg towards the Kirghiz steppes, the Altai, Semiryechinsk, Baikal, and Transbaikal up to the river Amoor and the Pacific. In the rear of the Cossacks' fortified line, protected by them, settled Russian agriculturists, affording also recruits for the Cossacks.

Historical.—We have no intention of entering into any details of the stirring and bloodstained history of Cossacks, but it would be hardly possible to understand their psychology without remembering some at least of the great deeds which have rendered them so famous. In the history of mankind, as in that of the earth, the past is never completely past; it leaves its traces and reacts on the present. The actual state of the Cossacks is powerfully influenced by their glorious traditions, which live in their souls and continue to inspire them.

The halcyon days of Cossacks belong to the seventeenth century, when Zaporog Cossacks fought as allies of Poland against Turkey under the headship of Konassewitch Sahaydatchny (1621), and somewhat later against the Poles themselves under the orders of Bogdan Khmel-nitsky, who rallied around his standard fifty thousand men. After having obtained some signal victories over Polish generals, Khmel-nitsky proclaimed the emancipation of the peasants, raised up the Don Cossacks, reinforced his army by Tartar troops, and with an army of 400,000 strong, marched to Germany, and was arrested only by the heroic resistance of a Polish noble of English origin, Andrew Firley. After the convention of Zborov (1649) the same Khmelnitsky invaded Moldavia, ransomed its Gospodar, and occupied Podolia.

In 1654 he concluded at Pereiaslav a convention with the Tzar Alexander Michailovitch, by the terms of which a portion of the

Ukraine, with its Cossack population, submitted under conditions of a considerable independence to the dominion of Russia. This sovereignty was often only nominal, the Cossacks of Ukraine remained restless, they changed their allegiance now and then, broke into fresh revolts, menaced all their neighbours, shed torrents of blood, until at last they were suppressed and partly annihilated by the vigorous action of General Tekeli, sent by Catherine II. (1790). History has preserved many narratives of the extraordinary exploits of the Zaporog Cossacks; they were renowned as reckless corsairs, they managed with admirable ability their light boats (*czayki*), pushed them to the estuary of the Dnieper, penetrated into the Azov and Black Seas, and, like the ancient Danes, wherever they made good landing, they spread slaughter, conflagration, and ruin. The most renowned of the Cossack leaders or hetmans were: John Mazeppa, elected as hetman by the Ukraine Cossacks in 1687—he attempted to throw off the sovereignty of the Tzar Peter the Great, took part in the battle of Poltava, after which he fled (1709) to Bender and there died; Yermak—the conqueror of Siberia; Stenka Razin, the famous robber, who succeeded in alluring 200,000 men to his standard; Bulavin, Nekrassof who revolted against Peter the Great; Minaef, Krasnoshchekof, Platov, leader of Cossacks in the war with Napoleon; Zelesniak, the leader of the rebellion of 1768; Gouba, Sava, Rozycki, Pugatchef and others.

With each of these names a whole epopee is connected in the Cossack mind, and they chant their heroes and transmit their high deeds from generation to generation. At the time of Catherine II. the Cossack name was so renowned that many of the Russian grantees and generals caused themselves to be inscribed as Cossacks (among others Count Potemkin). From the famous Zaporog and Little-Russian Cossacks have survived to our days a certain number of landowners (Cossacks) outside of the village communities who still enjoy greater prosperity than the rest.

Territory.—Cossack colonies occupy now a line extending for about 6790 miles from east to west and about 870 from south to north, or $42^{\circ} 57'$ to $55^{\circ} 28'$ N. lat.; from the Don and the Sea of Azov to the district of Vladivostok on the Sea of Japan, and from Terek to Orenburg they cover an area of about 220,000 square miles, that is, more than that of the German Empire. There are ten distinct Cossack colonies, or *voiskos*, each owning their land and waters granted to them in perpetuity by letters patent of the Tzar. The most extensive Cossack territory is that of the Don, having an area of 63,532 square miles, then come in order of their extension: the Orenburg colony, with 35,792 square miles; Transbaikal colony, 32,953 square miles; Ural, 27,221 square miles; Kuban, 25,566; Siberian, 21,560; Terek, 8220; Astrachan, 3135; and that of Amoor, 2542 square miles. The total population of these extensive lands is about three millions, of whom 71 per cent. are Cossacks and 29 per cent. non-Cossacks. The Imperial charters granting to the Cossacks land and privileges issued formerly have been recently renewed and solemnly announced to different Cossack armies, gathered in their respective head-quarters. We reproduce here

the Edict, dated 24 January 1906, addressed to the Don Cossacks. It runs as follows :—

"To Our faithfully dear and valiant Don Cossacks Army.

"Since the first days of its existence, more than three hundred years ago, the glorious *voisko* of Don has served faithfully the Tzar and Fatherland. Relentlessly pursuing the bright goal then opened for Russia in the development of her formidable might, it has ever since heroically and with an unalterable, limitless devotion of all her sons to the throne and Russian State, defended its frontiers, and, constituting thus a bulwark on its borders, contributed to its extension.

"In the years of heavy trials sent to the Russian Empire by the inscrutable designs of Providence, all the Don Cossacks, animated with equal affection and courage and always placing themselves in the ranks of the defenders of the honour and the dignity of the Russian power, have acquired by the spirit of military virtues always inherent in them and by their countless glorious deeds immortal fame, and the gratitude of the Fatherland.

"And now in the just-terminated war with Japan, and particularly in the actual heavy days of trouble, the Don Cossacks, strictly following the behests of their ancestors to serve the Tzar and the Russians faithfully and truly, have served as a model to all the true sons of the Fatherland.

"In recognition for such a devoted, indefatigable, and faithful service, We declare to the valiant and Our dear Don army Our particular monarchical benevolence, and confirm herewith all the rights and privileges granted to them by Our august Forefathers now resting in God, pledging Our Imperial word for the inviolability of their actual mode of service, which has brought to them historical glory, as well as of all their goods and possessions acquired by the labour, services, and blood of their ancestors and confirmed by Imperial edicts."

Similar edicts have been also granted recently to the Orenburg Cossacks army (23rd February 1906), the Ural Cossacks, the Terek Cossacks army (23rd April 1906), the Siberian Cossacks, and the Kuban Cossacks.

The lands of the Cossacks are unevenly distributed between 41° and 55° N. latitude, in the plains and in the mountains; they enjoy generally a healthy and moderate climate, and, with some exceptions, might be considered as quite favourable for the activity of man. The mouths of the Kuban, Terek, and Ural, as also the lower course of the Amoor, the Usuri, and the Sungatch, are malarial, and there are also in Orenburg some tracts north of Ui river and Pressnogorki that are considered unhealthy.

At the beginning the Cossack lands were mostly considered as collective property; they are now allotted to families, save for some reserves. The land granted to Cossacks is considered as equivalent for the sacrifices they submit to in order to wear arms in the service of Fatherland; the allotment of each male Cossack is from 8 to 32·4 acres. The pensions to officers are also granted in form of land. In 1775 on

those officers were conferred the rights of nobility and of the possession of serfs. Since the emancipation (1856) Cossack officers have been granted an allotment, according to rank, of from 247 to 4200 acres. It is now permitted to all non-Cossacks to settle in the Cossacks land, and consequently the proportion of civil population on those lands is increasing. In the absence of the Cossack owner his land is leased or administered by the community.

We shall give a very succinct account of all the Cossack regions:—

The Don Region.—Area, 63,532 square miles—that is more than the total of England and Wales; domiciled population, 2,575,878 (1897); density of 71 per square mile. The chief town is Novotcherkask. The region is divided into *otdjely* or districts, and has 117 stanitsa (villages) and 1918 hamlets. It belongs to the southern steppes of Russia, and extends from the upper Vorona affluent of the Don on the frontiers of the Voronej, Tambov, and Saratov governments, on the north, to the Sea of Azov and the mouth of the Eisk on the border of Kuban Cossacks land in the south. This great region may be divided into two principal parts, that of the north above the confluence of the Don and Medvieditsa, which is mainly agricultural, and that of the lower basin of Don, where are cultivated vines and fruits. In the Russian saying it is reputed to be a land of plenty, of milk and honey. The Don (*anc. Janais*) is revered by the Cossacks as the great benefactor, and is chanted in popular songs—

“Ho, you father, famous, quiet Don!
Our Nourisher, Don Ivanowitch,
You enjoy a splendid fame,
A splendid fame and a good parole.”

It is a mighty river 1150 miles long, having its source in a small lake in the government of Tula, and falling into the Sea of Azov by three mouths, one of which is navigable. It receives eighty affluents, of which the principal are the Sosna and the Donetz on the right, and the Khoper, the Medvieditsa, the Sal, and the Manitch on the left. Its course is obstructed by frequent sandbanks at low water, but in high spring water, when it overflows its banks, it is navigable as high as Zadonsk, 600 miles from its mouth.

The region on the left shore of the Don forms mainly a low, uniform, saltish, infertile plain, constituting a prolongation of the Aralo-Caspian steppes. Its monotony is occasionally interrupted by *tumuli* (kurgan) 33 to 50 feet high, considered as Huns' and Scythians' graves. On the right bank of the Don the region is traversed by the small chain of the hills of Donetz (about 500 feet high). Along the Don, the Khoper, and the Medvieditsa there are many lakes and marshes, swarming with small fish.

The districts of Donetz, Tcherkask, and Miuz are Carboniferous; the northern part of the country is Cretaceous; the south-west consists of Miocene beds. The Carboniferous rocks contain sandstones, argillaceous slates, millstone, and are rich coal-measures. The Cossack population is about 1,064,000, the proportion of men to women as 96 to 100.

Kuban land, twice as large as Switzerland (36,441 square miles), consists of two unequal and dissimilar parts, the one on the north

of the Kuban (ancient Tchernomorie), a low plain slightly descending from the heights of Stavropol towards Azov, traversed by numerous rivers running into the Sea of Azov, and the main chain of the Caucasus, and strewn with *kurgans*, covering the graves of its ancient inhabitants; the other on the south of the Kuban, hilly and mountainous, rapidly increasing in altitude from the Taman peninsula eastwards to Mount Elburz; on its southern limit stretches the Black Mountain, above 6000 feet, which slopes gradually northwards and very abruptly southwards. It is traversed by many rivers (Laba, Bjelaia, Selentchuk) and gullies.

The low part of the Kuban province has a generally fertile soil, but it is marshy, partly covered with jungle, and consequently unhealthy; it is poor in wood. There are many salt lakes.

Up to 1868 the Cossacks were recognised as the sole proprietors of these vast lands, granted at first (1792) to those of the former Zaporog Cossacks who had submitted to Russia and declared themselves willing to marry. Since that date, however, this exclusive ownership of Cossacks has been abolished, and the land left open to private purchasers.

The total population was estimated twenty-six years ago at 519,011 Cossacks, 149,749 non-Cossacks. The first have increased since by about 30 per cent. and are estimated now at 675,000. The proportion of men to women is as 100 to 97. The non-Cossack population is very mixed and steadily increasing (Russian, Tcherkess, Abkhasian, German, etc.).

The Region of the Terek Cossacks has an area almost as great as that of Bavaria (26,822 square miles), and consists of three principal parts—the eastern one, stretching along the left bank of the Malka and the Terek, down to its estuaries; it is marshy and flat, and subject to inundations; the middle one, along the Sunzha, is hilly, but also subject to inundations; the western, from Vladicavkas to the mouth of the Malka, along the left bank of the Terek, is mountainous. On the east there are sandy deserts or steppes, which go on extending. The mountain parts, in the upper region of the Sunzha, the Atta and the Kembileivka, all Terek's tributaries, are woody, difficult to cultivate, and have a rough and humid climate. There is, however, much fertile land on the banks of the Terek, and there are met excellent fruit-trees, vines, pastures and forests. In regard to this river, as also the Kuban, many particulars have been given in this *Magazine* for June 1899.

The portion of land belonging to the Cossacks constitutes about 32 per cent. of the whole area; the rest of it belongs to the non-Cossack population. About 14·5 per cent. of the land is considered as unfit for culture; 14·7 is under forests and orchards. The rest are arable and grazing lands. There are 4,750,000 acres of communal property, 316,000 acres belonging to officers, and almost as much is in the army reserves: mean lot for every Cossack, 58 acres.

The total population is given at 933,485, of whom about 200,000 are Cossacks. The chief town is Grosny.

The Astrachan or Volga Cossack lands, on both sides of the lower Volga, cover an area twice as large as that of Switzerland. The origin

of this Cossack colony is not exactly known, but it is mentioned in history as far back as 1581, when the *voevodes* of Astrachan, Lizki and Pushkin, were ordered to start against the Shamhal of Tarki (Daghestan) with 1000 Volga and 500 Yaik Cossacks. This land is fertile on the borders of the Saratov and Samara provinces; between Tchernoi Iar and Yenotaevsk (beneath Zaritzin) it forms an argillaceous, flat, elevated plateau; further down there are pastures on the right bank of the Volga, whereas on its left bank (Inner Kirghiz Horde) sand prevails.

The Volga nourishes the Cossack, and constitutes for him an excellent waterway.

The total Cossack population is estimated at 30,000: the proportion of men to women as 95 to 100.

Ural or Yaik Cossack land (27,221 square miles) is included within the governorship of Orenburg and stretches along the right bank of the Ural. The steppes beyond the Volga approach the Ural and possess a mountainous character, consisting of a long succession of grey or whitish-grey ridges, variegated with brown streaks and whitish-red spots of naked land. Usually mournful and sunburned, these steppes become highly animated in the spring, when they are covered with rich many-coloured pastures on which the Ural Cossacks, in incessant conflict with their enemies, the Kirghiz, graze their flocks and herds of sheep and horses. The area belonging to the Cossacks is almost as large as Bavaria, and their chief settlement is Uralsk. It was at first occupied by adventurous Don Cossacks, who fled hither after their defeat by Murashkin (1577), and destroyed the Tartar city of Saraitchek.

The Cossack land extends on the gentle southern slopes of the Obschy-Syrt, a range of detached hills, some of which, at the sources of the Derkul, a right affluent of the Ural, have an altitude of 600 feet, declining gradually to 70 feet. The land is most fertile, well wooded, and well irrigated. The small rivers draining the mountain range periodically overflow the deepest hollows and create a magnificent grazing ground. From Uralsk downwards the surface is flat, gradually sinking until at Kalmykovo it descends almost to the sea-level and passes into the sandy désert. The Ural delta overflows in high waters, and is permanently covered with jungle and bush, making a good protection for cattle in winter.

The land for purposes of administration is divided into three *oldjely*; it has thirty stanitsas and 138 hamlets.

The total Cossack population is 117,000; the proportion of men to women as 90 to 100.

Orenburg Cossack land is larger than Ireland, and is the northward prolongation of Ural Cossack land. It is traversed in different directions by broad but not high offshoots of the Ural mountains. Some parts of it, viz. the district between the Miuss and Ui (secondary tributaries of the Tobol) are almost at sea-level and are covered with numerous salt, briny and freshwater lakes. There are but few deserts: the soil is mostly fertile, and is partly covered with deciduous forests. From the main chain of the Ural, at the sources of the Ural and Ui rivers, there detaches itself a secondary watershed, attaining in some parts an alti-

tude of 1200 feet, and remarkable for its vast and beautiful forests. One of these—Dshobyk-Karagai—measures not less than 77,400 acres. Southwards the mountain range (Guberlinsky) descends rapidly into the valley of the upper Ural. The land is rich in mines.

The total Cossack population attains 378,000; the proportion of men to women is as 95 to 100.

Siberian Cossack land stretches in a long and narrow tract beyond the Ural, along the Presnogorky, Irtysh, Buchtarminsk, and Bisk lines, and, partly dispersed in the steppes of the Kirghiz Horde, covers an area almost as large as Bavaria.

The Presnogorky line along the Ishim, on the south of Tobolsk down to the steppes of Kirghiz, is strewn with numerous salt, bitter, and fresh-water lakes. It is only partly fit for cultivation in its alluvial parts; there are pastures and woods. Cattle and horse-breeding are hampered by the want of good water, and diseases arising from the sickly emanations of the stagnant waters and putrefying vegetable matters.

The Irtysh line, in the province of Akmolinsk, covers mostly a sandy, woodless tract along the river, which runs from Semipalatinsk to Omsk (462 miles) without an affluent. On the left bank of the Irtysh there are, however, some excellent pastures.

The Buchtarminsky Cossack line is situated on the northern offshoots of the Altai mountain range at an altitude of 680 to 900 feet. In the valleys of some rivers arising in these mountains there is little wood, but an abundance of good arable land, meadow, and pasture.

The Bisk (Büsk) line on the upper Obi, also on the northern ramifications of the Altai, at an altitude of 1000 to 2000 feet, has an abundance of pasture and arable land, and is besides richly covered with wood.

The lands of the Cossacks in the Kirghiz steppe are mostly fertile and favourable for grazing.

The total Cossack population is calculated in round numbers at 124,000.

Semirychinsk Cossack land constitutes a part of the government of the steppes between Siberia and Turkestan, has an area of 1041 square miles, and is naturally divided into a mountainous part, belonging to the system of the Thian-shan and a flat country traversed by many rivers, and sprinkled with a considerable number of lakes great and small. The name of the province signifies *seven rivers*, which are the Karatal, and its affluents the Kok-su, the Biien, the Akh-su with the Sarkan, and the Baskan, with the Lepsa.

There are other and even more important rivers such as the Ili, partly navigable, which falls into Lake Balkash and covers with its delta an area of above 5000 square miles. Among the lakes, Issik-kul is thrice as large as the Lake of Geneva, and the Ala-kul, the Sassyk-kul, the Baskan, are also noticeable. The low region slopes slightly towards the NE., in which direction the rivers flow into the Balkash; it is an argillaceous sandy steppe, supposed to be formerly the bed of a tertiary sea, being then in communication with the great sea of Central Asia (Han-hai). The Cossacks are mainly settled in the

mountainous country of Ala-tau, at an altitude of 2000 to 2500 feet.

There is now a very mixed population: about 51 per cent. Kirghiz, 24 per cent. of Sartes, 6 per cent. of Euzbegs, 5 per cent. of Tadjiks, 3 per cent. of Kuroma, and the rest is divided between the Russians (whose number has steadily increased), the Kiptchak, the Tarantchis, the Tartars, Kalmucks, Dungans, and Persians. The number of Cossacks is not much above 26,000; their capital is Verny. It is a promised land of Russian immigration, and quite recently the Cossacks had to concede 130,000 dessiatine of their reserves to Russians.

Transbaikal Cossack land is twice as large as Switzerland, occupies the southern and eastern part of Transbaikalia, and is divided by the Yablonovoi (Stanovoy) range of mountains, which converge with the northern buttress ranges of the Aldan high plain, into two parts—the eastern one with a mean altitude of above 2000 feet, and the western not much above 1000 feet. The first and higher part is very broken and woody, and is traversed by many ranges parallel to the main chain, and enclosing the basins of the Ingoda, Onon, Gasimur, and other rivers; on its southern extremity it passes into an undulating steppe. The second and lower part lies in broad and elevated valleys formed by the Ingoda, the Selenga and its affluents, the Dshida and Tshikoi. As there is only one easy passage through the Stanovoy range (road to Tchita) communications here are very difficult.

The chief town is Tchita. Total Cossack population, 187,000.

Amoor Cossack land extends in the form of an oasis along the deserts of the Amoor and the Ussury, as also on the banks of the lake Chanka on the north and east of Manchuria. This colony, which is of recent origin, is divided into three otdjely (districts); it has seventeen stanitsas, about 100 hamlets, and 3200 farms;—its chief town is Blagovechensk (9300 inhabitants). At the confluence of the Zeya, the most important tributary of the Amoor, the Cossacks settled when detached in 1858 from the Transbaikal Cossacks, and they were obliged to fit out and maintain two mounted regiments and two foot battalions. This land is subject to inundations, and otherwise the conditions of life must be rather dreary, for the government has been obliged to strengthen their number with military outposts.

The total Cossack population may be estimated at 28,000.

Ethnography.—The Cossacks sprung from an admixture of different races, but the identity of their calling and their mode of life and warfare have stamped on them all a common Russian cachet. The great majority of Cossacks are Great Russians, they are settled mainly on the Don; Little Russians now preponderate in the Kuban and Terek Cossacks army; there are also to be found on the Don, in the Orenburg, Semirychinsk, Siberian and Transbaikal Cossack colonies. Tartars are numerous among the Don, Ural, Orenburg, Siberian, and Semirychinsk Cossacks; they are also to be found among the first three Cossacks' colonies a not inconsiderable number of Kalmucks. In the Transbaikal Cossack army were incorporated a number of Buriat and Tungus, and among the Caucasian Cossacks there are now some Caucasian Highlanders, Lesghins,

Tcherkess, Tchetchen, and others; finally, in the Orenburg Cossack army there are Bashkir, Mordvin, and Tchuvashes. There are few Jews, about 0·5 per cent.

Cossacks are generally a beautiful race of men, and there are ever to be found on the Don, and especially on the Terek and Kuban, splendid specimens of men and women. They are almost all excellent horsemen, robust, enduring, weather-beaten, soldierlike, hardened, adroit, everything that the bearing of arms, the life in the open air on horseback can make them. Each Cossack army has, however, some special peculiarities.

The Caucasian Cossacks, and especially those of Terek, have much intermingled with Caucasian mountaineers—Tchetchen, Tcherkess, and also Nogai and others; they have borrowed of them many of their peculiarities and have improved in bodily structure. The Terek Cossacks are a beautiful tribe. Their women are particularly remarkable, and are reputed to be in many ways superior to their masters, as more forward and even more intelligent. They combine the classical, regular features of Tchetchen women with the powerful constitution of the women of the Russian northern type.

The Cossacks speak Russian, but have many words of their own, and they give their own significance to some Russian words.

The Cossack as warrior.—The Cossack is a born freebooter, he has all the qualities of a militia horseman and is quite efficiently adapted for outpost service. Cossacks are excellent for foraging parties, surprising the enemy, cutting off his communications, pursuing him when defeated. Only fifty years ago Cossackdom constituted a military caste which it was forbidden to leave. Among the Caucasian Cossacks even a female member of a Cossack family could marry out of the caste only by special permission.

In 1856 was begun the reform, realised ten years later, according to which Cossackdom ceased to be a caste, its military affairs were separated from its civil business, and its administration from justice. The law of 1874 thoroughly remodelled the whole military organisation of Cossacks; they are now incorporated in the field troops. The military organisation of Cossacks thus underwent considerable change with the strengthening of the central power of the State. Very loose at first, with considerable freedom in the choice of the chiefs, mode of operations and generalship, it became more stringent and more appropriate not only to military requirements but also to the increased civil and peaceful interests of the country.

Before 1835 there were no fixed rules for the military obligations of Cossacks; each individual served as long as he was capable. In that year it was decreed, at first for the Don Cossacks and later for the others, that each capable Cossack of nineteen years of age is liable to serve for thirty years, and that all male children of Cossacks, on the attainment of seventeen years of age, are to be enrolled as minors for two years in the recruiting schools. The reforms of Alexander II. have considerably lightened the service of Cossacks, they have introduced stricter qualifications for recruits, increased the number of the dispensed, and

thus caused a greater inequality among Cossacks, many of whom can pursue different peaceful, lucrative callings.

Cossacks are now called at nineteen years to draw lots, save pupils of high schools and professionals. According to custom, at the entrance into active service the recruits simultaneously admitted exchange between themselves various gifts. Cossacks when set free constitute a class of men who maintain their right on the land, but have to pay during twenty-two years a special tax of 15 roubles a year.

Cossacks, treated by Napoleon I. as *miserabile cavalleria*, have proved themselves to be an excellent instrument of conquest over the multitude of mostly semi-barbarous people Russia has encountered in her expansion; they have been called to fight, and have developed in quite an extraordinary degree watchfulness, vigilance, readiness for an unguarded attack, endurance—in fact all the qualities necessary for the struggle in the van of an army.

From his tenderest years a Cossack learns to ride, and with maturity he becomes an accomplished horseman, capable of performing on his enduring and well-trained horse the tricks one admires only in the circus. His horse is a true companion, as capable as himself of lying in wait for hours without betraying his presence.

Besides Cossack cavalry (a force of 268 squadrons [hundreds] in time of peace and 868 squadrons on war-footing) there are also some companies of Cossack infantry or *plastune* (to lie prostrate), so called because their special task is to search for traces of their enemies in bush or otherwise covered places, and to lie in wait. A *plastune* is expected to be not only a good shot, but also a good pedestrian, enduring and patient in the highest degree. The *plastunes* acquired great renown in the wars with Tcherkess on the Kuban.

All Cossacks are warlike and proud, faithful in their service and true to their Tzar. All the traditions, aspirations, songs, and deeds of the Cossack's life, for centuries, have centred mainly in warlike prowess; war has ever been considered by them as a glorious undertaking, opening a large field for audacious daring and all manly virtues.

In their dealings with their enemies, or whom they are bidden to consider as such, they are not only coarse, cruel, violent, but even ferocious, and it would be easy to fill volumes with instances of their atrocities. In a Russian popular pamphlet about Cossacks (Alexandrov, Moscow, 1899) one finds narratives of how the Ural Cossacks knocked down the Kirghiz so unmercifully, that even the Ural groaned as with pain, how they pursued them like wild goats, how a famous Cossack—Vasily Struniashof—descended the Ural on a small craft with two guns, trying to approach unperceived the Kirghiz camp and kill with a single shot two of them. When in pursuit of a retreating foe they utter singular savage cries, and woe to the unfortunate falling in their hands. The wars with Napoleon, and especially the Caucasian wars, have left as inexhaustible chronicles of human cruelties as of heroic deeds.

The Cossacks form about 6 per cent. of the regular Russian army; the proportion is 7 per cent. for West Siberia and 22 per cent. for Turkestan.

In relation to different arms the proportion is 1 per cent. for the infantry, 77 per cent. for the cavalry, and 50 per cent. for the artillery.

We do not know exactly the total Cossack force, but we may evaluate it approximately at 130,000 in time of peace and four times this number in time of war. The Cossack has to serve twenty years, of which three years are for training, twelve at the frontier, and five in reserve. The twelve years' service is divided into three callings, four years each. One third of the male Cossack population fit to bear arms, constitute the regiments of the first calling ($49\frac{1}{2}$ regiments). Actually the Cossack has only three years' service. The highest authority is vested in the superior administration of the Cossack armies. Don and Siberia Cossacks have their Atamans, nominated by the Crown, with the rights of Governor-General; the other Cossacks, *voisko*, are placed under the control of the General-Governors of the parts of the empire to which they belong. The supreme Ataman of the Don Cossacks is the heir-apparent.

Uniform and Arms.—The Caucasian Cossacks have borrowed their beautiful uniform from the Caucasian Highlanders (Tcherkess); a close-fitting, woollen or silken, short *besmet*, a red or blue shirt with a collar and an upper dark green coat—*tcherkesska*, with a cartridge box on both sides of the breast, a *papacha* (shaggy sheepskin cap) on the head, and *viatchiki* (soleless morocco boots), for the feet, as well as *porshni* of raw skin requiring to be wetted before being drawn on. For protection in cold weather, and for a covering a Caucasian Cossack has his *bureca*—a large, shaggy, foldless mantle, and his *bashlyk* or bonnet. Armed and dressed as a Tcherkess, the Caucasian Cossack is scarcely distinguishable from him. Other Cossacks wear dark green or blue tunics with epaulets, partlets, and collar edgings of different colours, broadly striped pantaloons of the colour of the coat, and a cap with a coloured band, a visor, and a cockade.

Most Cossacks are armed with a Berdan-gun, a *shashka* (a crooked sabre), and the famous whip. Caucasian Cossacks have daggers, and the first file of most squadrons bear lances.

The Cossack must provide himself with his arms and his equipment, as also his horse at his own cost; he wants for that from 150 to 300 roubles; he must keep all that in order; in case of his being incapable of providing himself with all necessary for the service he is helped out of communal resources.

A Cossack bears all his arms separately so as not to allow any clanking; he takes good care of them; and though his dress may be ragged, his arms are always in good order.

The Cossack as Policeman.—The internal troubles of Russia have recently caused the Government of the Czar to employ Cossacks as a police force, and many landlords also menaced by agrarian disorders recur to them for the protection of their goods. The intervention of Cossacks in the maintenance of civil order has a brutal and often a sanguinary result; they do not proceed with much nicety and discretion, and use freely their dreadful *nagaika*, and even their firearms. Called to bring a tumultuous crowd to reason, they do not endeavour to disperse it, but they pack it

together and then trample upon it, playing furiously with their whips and *shashka*. They do often exercise violence upon the population, violate property, outrage women, and provoke most bitter complaints from the civil population. All Cossacks do not, however, approve of their employment as a police force, and in the midst of their female population, their wives and their sisters, there seems to reign some discontent at such pitiless proceedings against the revolutionary elements of the Russian people, their Christian, though slightly inferior brethren, called a little disdainfully the *catsap*. There are even some recorded instances when the Cossacks refused to be employed for police duties.

The Cossacks, in fact, are in no way ideal policemen; they are rather too brutal for these delicate functions, and besides, they enjoy among the Russian people the not wholly unmerited reputation of being very clever and audacious thieves—which is not a useful quality in policemen.

The Cossack as Citizen—Customs and Manners.—The Cossack is not only a warrior and a policeman, but he is also a peaceful and industrious citizen, who has his lands to till, his garden to cultivate, his cattle and horses to raise; his fishing, hunting, and a number of trades and occupations to look after. Compared with ordinary Russian peasant and tradesman, the Cossack may be considered as a privileged being; he is more cultured, and he has a prouder and more dignified bearing than the Russian peasant. Cossacks have to give to the state a difficult and perilous service, but on the whole they enjoy a life superior to that of the rest of Russia. Their allotments are superior to those of Russian peasants, they are mostly settled along great rivers abounding in fish, they pay no taxes, they are little interfered with in their industries and daily work.

The Cossacks are in consequence and on the whole more conservative and more satisfied with their lot than the rest of the Russians. There has certainly been manifested some dissatisfaction in the ranks of the Cossacks, and there are some elements among them who would like to reform Cossackdom in a radical way, but the great majority remain profoundly conservative. They respect their elders, maintain their faith, and their old customs.

To understand the Cossacks it is necessary to remember that they are mostly the descendants of those terrible fanatics of liberty and orthodoxy, the Zaporog Cossacks, who in their appeal to new recruits said, "We urge to join us all who are ready to be impaled, to be racked, quartered, to suffer all tortures for the Christian faith."

The Cossack observes severely all the fasts in this sense, that on those days he does not eat either flesh, nor any other animal food, except fish, and that his meals are prepared with vegetable oil. He goes to church on holy days, and he likes to put one or even a whole bunch of wax tapers, before the *ikon* (holy image); he does not eat before the mass, and on Sunday evenings he likes to read the Scriptures and the history of the saints. There are a considerable number of *starover* or old believers among the Cossacks (about 10 per cent.), and about 4 per cent. of non-Christian creeds.

On the Don and the Ural the wooden or stone houses of the Cossacks

look far more comfortable and are more spacious than the ordinary peasant Russian *isba*. A Cossack's house consists usually of two neat and bright rooms, provided with a large Russian stove, adorned with numerous *ikons* and the portraits of the reigning family, and furnished with beds, benches, tables, and sideboards. There are feather beds, carpets, cushions, bedclothes; and along the walls, arms and copper ware.

The Cossack eats and drinks abundantly and well, he crosses himself before and after meals, as he crosses himself also when yawning and on many other occasions. At dinner on week-days he has bread, cakes, curdled milk, cabbage or fish soup, and mutton. On Sundays he has in addition, fish, salt beef, fowls, and even sometimes venison; on fast-days he eats freely of cucumbers, water-melons, pumpkins or gourds, dried sturgeon, caviare, herring, potatoes, fruits, etc. He does not eat without drinking, but washes down his food with bumpers of *tchihir*, taken always at one draught, even by the ladies. The Cossack's capacity for drinking is great, for he can take at once a whole *tchapura*! a wooden chalice containing eight glasses. In their leisure hours the Cossack's youth, and especially the women, gnaw continually grains of turnsole.

Cossacks are strong and adroit, but they willingly leave to their strong and patient women not only house but also field and other work. They indulge in warlike sports—shooting, wild galloping, lance-throwing, and they like also to chant songs of their famous heroes of old—Yermak, Razin, Bulavin, Nekrassof, Minaeff, Krasnoschekof, Platov, Ilovaisky, and others.

A Cossack will endure any climate; he has admirable instinct, which permits him to find his way in the wildest tract. His passions are easily aroused, and there are many stories of sanguinary conflict between rivals, and even between father and son, the Cossack marrying young and leaving his wife, on account of his service, for a long time alone.

There are a number of educated men among Cossacks, but ordinary Cossacks are generally very ignorant and highly superstitious; they seem to remain in some respects very children of nature, noisily demonstrating their joy in success, but also easily dispirited in adversity. The Cossack believes in devils, sorcery, spells, etc. With all this they are cunning and patient in stratagems. They are very hospitable. Every one is happy to have friends (*kunak*), and to keep faithful to his friends. The Cossacks do not generally exercise any marked influence on the aborigines they are brought into contact with; on the contrary, they easily adopt local customs. They are pious; on every occasion they invoke the name of God, and perhaps as often that of the devil. At the beginning of his meals, in drinking one's health, at any supposed danger, and even at the moment when, pointing at his enemy, he pulls the trigger of his musket, the Cossack says "In the name of the Father and the Son."

The manners of Cossacks are what their warlike habits, the use of arms, long absence from home, and severe duties have made them. To be a good fellow among them signifies to be faithful in friendship and hatred, a strong drunkard, an adroit robber of horses and cattle, a singer, and a player on the *balalaika*, a good sportsman, a hoaxer, a favourite

with women, and before all a *djighit*, a dauntless horseman prepared to kill and to be killed.

Cossack women are highly praised, and considered by many as superior to their men in intelligence and industry. They do not enjoy, however, from their men the consideration due to their value and are even often treated harshly. Heavy work in the house, or courtyard, and the field is left to them; to them is principally due all the welfare and comfort the Cossack enjoys. The habit of heavy masculine work and industry have developed in the women intelligence and muscular strength, and also a considerable amount of authority in the family life. The Cossack's house and all his goods are acquired and maintained, thanks to the labour and the care of his women. Affecting for them before a stranger a kind of scorn, the rude Cossacks cannot, however, but recognise their skill, powerful good sense, and firmness of character.

Cossack industries.—Cossacks possess rich lands, beautiful rivers with plenty of fish, herds of cattle and horses; they are agriculturists, gardeners, fishermen, tradesmen, and men of commerce, they pursue many kinds of industries, but with all that, they do not constitute a self-sufficient state or community taking the ordinary chances in the universal struggle for life. They are a privileged community, or rather a number of communities, provided with many good things of this world somewhat at the expense of the state of which they are members. They are insured to a certain degree against the perils accompanying the free struggle for existence, and probably in consequence of that, as also of the obligations imposed on them and of their backward state of culture, their industries are not progressive.

Agriculture.—In the early days of Cossackdom, among Zaporog and Don Cossacks tillage was despised and even interdicted, it being the occupation of the peasants residing among them, but now agriculture has become the most important industry of Cossacks.

Apart from the considerable extent of land belonging to the always increasing class of civilians, peasants, artisans, craftsmen, etc., which since 1867 have obtained the right to buy land and become proprietors in the formerly exclusive Cossacks domain, the tillable land in their possession, which has been estimated in the seven principal Cossacks regions at about 90 million acres, falls into three categories: communal lands, about 66 per cent. of the whole, reserve lands 22 per cent., and the lands belonging to officers 12 per cent. These numbers are, however, only provisional. The communal lands are in the possession of villages or stanitsas, they are divided among the male members of the commune at their attainment of seventeen years of age, on the basis of an allotment which varies in different Cossack regions, according to the quality of the soil, from 20 to 216 acres, the mean being 12 dessiatine (32·7 acres).

The reserve land is considered as belonging to an entire *voisko*, and in a given Cossacks region it is administered by local authorities under the upper control of the War Ministry. It is a state fund destined to subsidise the Cossacks in case of particular want, to help in furnishing

armaments, etc. The proceeds of the land go to supply the funds in possession of each *voisko*.

According to an estimate made twenty-five years ago, the total funds in cash at the disposal of the Cossacks were eighteen and a half million roubles, or about seventeen roubles per head for the male population. We have no more recent data.

Prosperity is greatest among the Ural Cossacks; the Don, Kuban, Orenburg, and Siberian are also well off, whereas the Transbaikal and Amoor Cossacks suffer from the great distances of any centre of civilisation and of markets; Terek, Astrachan and Semireychinsk Cossacks seem to be the poorest. The usual cereal crops are wheat, rye, barley, oats, buckwheat, millet, and potatoes.

All Cossack lands, save the Transbaikal and Astrachan regions, produce cereals in quantities sufficient for the needs of the population, while the Don and Semireychinsk region has a surplus. Apart from the arable land, the Cossacks cultivate orchards and gardens, they raise cabbages, cucumbers, melons, apple, cherry, and plum trees, and they have some special crops such as flax, hemp and tobacco. The Don Terek Cossacks have a considerable acreage under vines, and all have vast stretches of meadow and pasture land.

The agricultural methods of Cossacks are of a primitive description, their plough is heavy and unmanageable, and they do not generally introduce new agricultural machines, preferring to make their patient and strong women do the work.

The Cossacks are also apiculturists; in the Kuban, Don, Terek and Siberian Cossack regions they produce honey and wax to the value of about half a million roubles. Next to agriculture, the most important industry of Cossacks is cattle and horse breeding.

Their live stock was valued some time ago per hundred heads of Cossack male and female population for all the ten Cossack regions as follow:—

Horses, 60 (Ural 140, Transbaikal 124, Don 35).

Cattle, 94 (Don 136, Ural 134, Kuban 126).

Sheep, 161 (Ural 503, Kuban 290, Transbaikal and Don, 276).

In the Kuban and Orenburg regions there are besides about 300 pigs per 100 Cossacks.

The Cossack horse is a cross-breed between Russian, Kalmuck, Kirghiz, and Bashkir horses, and has excellent qualities. It is rather small (except Black Sea Cossack horses), but well built, extraordinarily enduring even under bad nurture; being left much at liberty in the steppes, it has acquired much prudence and very acute senses. The "Black Sea" horse, from the Dnieper, has a short neck, is strong, enduring, and sturdy. The Caucasian Cossacks have excellent horses of mixed Arab and Karabagh blood; there are also Nogai and Kabardine horses, admirable mountain climbers.

The Russian Government favours horse-breeding, and has established studs on the Don and the Caucasus, and has assigned for this purpose in the Don Cossack region an area of above two million acres.

The cattle of the Don Cossacks are renowned for their size and excellent qualities. The sheep (Moldovan race) have long but hard wool. The poor animals are badly cared for and often perish from the inclemency of the weather. In all the Cossack lands where there is also some percentage of non-Cossack population, the number of live-stock belonging to the first is far superior to that belonging to the last (in the ratio of 82 to 16).

Fisheries.—Cossacks are good fishers, and as almost all their possessions extend along the great rivers, abounding in fish, or are on the shores of the Caspian, Black, and Azov seas, or on the great lake of Baikal, fisheries constitute a considerable item in their prosperity. The streams of water traversing the lands of Cossacks, as also the parts of the seas adjoining these lands, are the undivided property of the respective Cossack *voisko*. Fishing is permitted to all Cossacks, with only such restrictions as are considered necessary to secure undisturbed spawning. Besides the great fisheries belonging to the headquarters of a *voisko*, some of which lie even outside Cossack land, and which are leased, there are also fisheries in the lakes and rivers inside the limits of a *stanitsa* and belonging to all its members.

The richest fisheries are on the Don and the Ural; after them come those of the Kuban and Azov Sea, as also those on the Caspian and Volga. In these waters are caught some kinds of sturgeon (white and stellated), silure, sandre, bream, *cyprinus vimba*, carp, herring, and dab. On the Ural they distinguish "red" and "white" fish: "red" fish is more valuable but scarce (*Acipenser sturio*, *A. ruthenus*); it is reserved for export; the "white," by far the more abundant, is consumed by the Cossacks on their numerous fast-days. From the "red" fish is obtained caviare, *viosiga* (dried back tendons), and isinglass. In the cold season the fish is served fresh, in hot season salted or dried.

The products of the fisheries are not unimportant, and, according to some statistics, may be valued at about four to five million roubles a year, more than half of which belongs to the Ural region, where they are the main source of income. The river Ural is recognised as the undivided property of the Ural *voisko*, and the fishing is permitted to all Cossacks on the condition of observing certain established, pretty complicated rules. The Ural Cossacks enjoy also the right of fishing on the Tcholkar lake and its tributary, the Ankotys.

In the Astrachan *voisko* all waters are leased for fishing, the administration reserving to themselves only some rights regarding train-oil and the salting.

The fisheries on the Don yield about 1000 tons per annum.

Mining Industries.—In the Cossack lands coal, naphtha, pig-iron, and salt are obtained. The exploitation of these is left free of taxes.

The coal on the Donetz began to be extracted in 1842; since then the exploitation has steadily progressed, and the output rose from 1,624,720 tons in 1884 to 7,413,000 tons in 1898.

The naphtha wells are worked in the land of the Terek and Kuban Cossacks; they are leased. The Grosny oil-fields yielded, in 1899, 406,000 tons of crude oil.

Pig-iron is obtained on the Don—1,333,258 tons in 1899; it is partly exported.

There are many salt lakes in Cossack land: on the Don the lake of Manytch; in Kuban five groups of salt lakes, on the shores of Azov, Bugas, Petrovsk, Akhtarsk, Achuev, Yassan—forty lakes in all; on the Ural ten salt-lakes.

Cossacks obtain their salt for consumption by means of taxes levied by their own administration; where there are no salt-works, they get it from the state—77 lbs. per head yearly.

There are some other industries, such as the exploitation of the forests, and hunting. A Cossack may be also a tanner, a potter, a tradesman, an artisan of various kinds, a craftsman, but there is no particular Cossack industry, and in all kinds of industries the Cossacks are rather backward; their principal preoccupation of being ready for war prevents them from engaging in peaceful pursuits. Most Cossacks are excellent sportsmen, the hunting of wild boar, deer, and hares being a favourite pastime with them.

Independently of their military tastes and pursuits, the industrial activity of Cossacks is hampered by their dependence upon their authorities even in private and industrial concerns.

Manufactures.—The Cossacks have neither time nor knowledge nor disposition to employ themselves in manufactories; they leave it to the non-Cossack portion of their population, called outlanders, which is steadily increasing. There are counted some 1500, mostly small, manufactories, in Cossack land, viz. the oil industry, tanyards, brick-making, potteries, candle-making, etc., producing a sum of about 10 to 12 million roubles yearly. It is a very poor result indeed, when compared with the industrial activities of many free countries, such as Switzerland, for instance, whose population is only equal to that of the Cossacks, whose territory is only one-fourteenth part of that occupied by Cossacks, and which exports manufactured goods to the value of 900 millions—that is thirty-six times as much as the Cossacks.

Commerce.—The Cossacks are not merchants, and commerce as a peaceful occupation, requiring for its success peace, order, and equity, is incompatible with their martial, restless spirit. Some Cossacks regard commerce with sheer contempt; they prefer to take rather than to buy. For long the commerce in Cossack land was carried on exclusively by the non-Cossack portion of the population, but the Cossack at least perceived the inconvenience of being always cheated by outlanders, and they demanded to be permitted to carry on commerce for themselves. In 1835, on the Don, and later in other parts of Cossack land, there was instituted a commercial class among the Cossacks, who, in return for a special tax levied for the benefit of the *voisko*, were liberated from military service and were granted some privileges.

Later on all merchants in Russia had to pay for their patents, and the loss sustained to the Cossack treasury from the suspension of the special tax on Cossack merchants was made good by the state. But the number of the last was very inconsiderable (about 4500), and the trade now, as before, is mainly carried on by the non-Cossacks.

The exports consist of raw and half-manufactured goods, imports of manufactured goods, and especially textiles, of a total value which has been estimated at 47½ million roubles in 1878, and, considering its annual increase of about one per cent., it cannot be now much above 64 million roubles.

Cossack Finance.—Cossackdom is a kind of state in the state which levies taxes, owns vast extents of land, waters, mines, and forests, and has its proper grant from the administration, and so on. The total revenue of all the ten Cossacks lands was given twenty-six years ago as equal to 6,396,801 roubles; the expenditure left a balance of 93,000 roubles. We regret not being able to give the actual figures for the present time, but having regard to the slight progress in agriculture and industry made by the Cossacks, we do not suppose the total to be much above 10 million roubles. The richest communal properties are in the Don, Kuban, and Ural Cossacks *voisko*; the poorest on Terek, Semir-yechinsk, and Transbaikal. The expenditure on public schools varies from 10 to 40 per cent. of the budget. There is as yet not a single high school in the Cossack lands.

Conclusion.—Russia is on the eve of radical reforms; it is highly probable that, with the emancipation of the great masses from the civil inequalities and their participation in the councils of the great Empire, the external policy of Russia will be more settled, and its limits will not be further extended, and the question naturally arises, What will become of the Cossacks? Are they to enjoy indefinitely their present privileged position, or are they to become like the other subjects of Russia?

The Cossacks have played a great historical part in the increase of Russian power and dominion; they continue to retain considerable military importance, but does not their maintenance as a privileged and military caste constitute some danger to the peaceful development of Russia?

It is remarkable that among the Cossacks themselves there exists some, if not widespread, discontent. Some Cossack deputies in the last Duma made themselves interpreters of the complaints of Cossacks. It seems that the land and the privileges they possess do not always constitute for them a sufficient equivalent for their obligations to serve as the militia of Russia. Some of them believe that they have reasons to complain of a serious economic crisis, provoked by an unusually prolonged retention of their men under arms; others affirm that they have been outraged in their best traditions by being employed for the suppression of the aspirations for freedom they themselves have always cherished. The discontent may as yet be only quite partial, though there have been already some revolts to suppress in which the military authorities have had recourse to regular troops; but there are not the Cossacks' interests alone to be considered.

What is the advantage to the Russian state in the further maintenance of the privileged status of the Cossacks? There is certainly a financial advantage, viz. the fact that the tax on the Cossacks, like that on all ordinary Russian subjects, is insufficient to cover the expenses of the military department for the levy, the equipment, and the armament

of the Cossack troops, which is now done at the cost of the Cossacks themselves. It is said, further, that the military charge falls more heavily on the Cossacks than on the rest of the population. In each 1000 men the Cossacks give yearly 17 recruits, the other population only 5; on actual service there are 62 men for each 1000 among the Cossacks, and only 24 among the rest of the Empire; the respective numbers in time of war are as 245 to 57. The mobilisation of Cossacks is also proceeding more quickly than that of the rest of the army.

We are not concerned to weigh the validity of all these arguments, but certainly the maintenance of the Cossacks is not exclusively either a financial or a military question; it is also an important social and political problem; there are implicated important considerations of civil and social importance.

There is, besides, to consider that Russia may no longer need a particularly warlike population on its present frontiers, and that among this population itself dissatisfaction may increase in consequence of the progress of more peaceful ideas and of changed circumstances, which do not favour the military spirit and counsel the changing of arms for the plough.

The transformation may be gradual, without disturbing the Cossacks' rightful possessions. The Don and Ural Cossack may become quite as peaceful citizens as are now numerous Little-Russian Cossacks, whose ancestors were the most uncompromising of true Cossacks.

In some respects the Cossacks are better prepared than the rest of the population for realising the new course Russia is about to enter upon; they have already enjoyed a certain autonomy, freedom, and electoral rights. Their rich lands may become the granaries of Russia.

It is certain that the Cossacks are in narrow straits just now, when the whole of Russia is in the midst of an alarming crisis. The war with Japan had already necessitated extraordinary efforts, and now, independently of the forty-nine and a half regiments of the first calling, there are mobilised eight regiments from Orenburg, three regiments from the Ural, and one regiment from other Cossacks, except Caucasians, as if it were a time of war. Thanks to these enforced duties, lasting three years, many Cossack families, writes *Step*, organ of the Orenburg Cossacks, are ruined, their fields remain untilled, their houses unrepaired, and they have no cattle. It is true the Government has set apart seven million roubles for their assistance, but this is far from being sufficient. These and similar complaints from Cossackland, though partly explicable by the particular conditions of the time, do not prove the excellency of the system, and may be considered as favouring a radical change of a state of privilege into that of equality before the law, of an exclusively martial spirit into a more balanced use of all the human faculties.

Viewing the general progress of the world and the increased peaceful competition of all human races, it is time for the Cossacks to apply their great energies to other than military prowess, to take to schools, science, art, industry and commerce, and to make a better use of the immense natural resources offered them by their vast and beautiful lands and splendid waters.

PROCEEDINGS OF THE ROYAL SCOTTISH GEOGRAPHICAL SOCIETY.

At a Meeting of Council held on the 27th March, the undermentioned lady and gentlemen were elected Members of the Society :—

Dr. A. Gall.

Miss A. J. Aldons.

W. Henry Bruce.

Thomas Murdoch, J.P.

DIPLOMA OF FELLOWSHIP.

The Council conferred the Ordinary Diploma of Fellowship on J. Penman-Browne; Robert M. Macdonald; Fred. J. Pack, B.S.M.E., A.M., Ph.D., Professor of Geology and Mineralogy, subject to their complying with the prescribed conditions.

CENTENARY OF THE GEOLOGICAL SOCIETY OF LONDON.

The above Society intends to celebrate its Centenary on the 26th, 27th, and 28th September next, and the President of the R. S. G. S., Professor James Geikie, F.R.S., has been appointed delegate to represent this Society at the celebration and to present an address of congratulation.

GEOGRAPHICAL NOTES.

EUROPE.

The Lagoons of Venice.—In the March number of this *Magazine* it was noted that the Reale Instituto Veneto had decided to investigate the phenomena connected with the water-ways of the Lagoons. We have now received a Preliminary Statement by Sig. Magrini, in which he formulates his programme as follows :—

1. The study of the propagation of the tidal wave along the western coast of the upper Adriatic from the Porto Corsini to the Porto Buso, and the investigation of the bottom of the channels at the entrance of the ports. 2. The study of the tidal wave in the lagoon fed by the port of Malamocco. Sig. Magrini hopes that these investigations will go far to aid future procedure.

ASIA.

Sven Hedin's Expedition.—This explorer reached Shigatse on February 9, and full details of his journey are now available.

The high plateau land of Central Asia was reached by a pass 19,500 feet above sea-level. Once in the Ling-tzi Thang and Aksai Chin (White Desert) travelling proved much easier than had been anticipated. Excellent grass was met with every day, and the expedition was always able to pitch camp in the neighbourhood of water, though sometimes this necessitated long marches. The country was com-

paratively flat and the going good, especially after the autumn frosts set in. To north and to south magnificent panoramic views spread themselves out before the traveller's eyes, on the one hand lying the parallel ranges of the Kuen Luen mountains, and on the other hand the ramifications of the Karakorum system. Keeping at first an easterly and afterwards a south-easterly course, Dr. Hedin avoided as far as possible the region already visited and mapped by other travellers. On reaching Lake Lighton, which Dr. Hedin describes as one of the largest and most charming lakes he has seen in Tibet, part of the caravan was sent back. Two excursions were made on the lake and a number of soundings were taken. Though he had 220 feet of sounding rope with him, Dr. Hedin was twice unable to reach the bottom. On the other hand, Pul-cho and Yeshil-kul, two other lakes in the same region, were found to be quite shallow. Pursuing his journey he entered an expanse of unknown country, and here the real hardships of the journey began. The transport animals dwindled in number day by day. There was an abundance of water, but rarely any grass; sometimes not even yak-dung was to be had for the camp fires. Gradually, however, as the expedition advanced to the east, the character of the country improved. Here and there a new lake was sighted, and at least every other day a pass had to be crossed.

Eventually the Bogchang Tsanpo was reached and was followed for some days. Christmas was spent at Dumbok Cho, intense cold being experienced, the thermometer going down as low as -35° Centigrade. Storms of wind and sometimes snow blew daily from the west-south-west. By the time they reached the northern shores of Ngantse Cho both men and animals were completely exhausted.

On renewing the march southwards the expedition entered upon a very complicated stretch of country extending from Ngantse Cho to the Tsanpo, or Upper Brahmaputra. Several comparatively low passes had to be crossed, and five which reached an elevation of 19,000 feet. Bitterly cold weather was experienced, with driving snowstorms; but, though involving great hardships, the journey was extremely interesting and instructive. The first high pass is Sela La, situated in the gigantic mountain range—one of the highest in Asia—that forms the watershed between Ngantse Cho and Dangra Yum Cho, on the one hand, and the Upper Brahmaputra on the other. Geographically this is one of the most interesting passes Dr. Hedin has ever crossed, marking as it does a point on the frontier between the plateauland, with its self-contained basins, and the waters that eventually find an outlet in the Indian Ocean. The blank spaces on the map of this region have been filled in by Dr. Hedin with a veritable labyrinth of mountains and rivers. In between all the high passes the expedition crossed rivers flowing due west to the My-tsanpo, which in turn flows southwards to the Brahmaputra and is a great river, even in winter when frozen over. The last pass, La Roch, presented no difficulties, and from its summit the travellers obtained a magnificent view over the Brahmaputra valley, the great river being seen far below, winding through the valley like a streak of silver. From the summit of the pass there is a descent of about a thousand feet

to the large village of Ye, or, rather, group of villages and temples, where the travellers found the first trees they had seen for many months. As was invariably the case in Dr. Hedin's experience, the natives showed themselves friendly and hospitable. Turning then eastwards, the expedition followed the course of the Brahmaputra for three days to Shigatse. On the last day, from Sta-nagpo Dr. Hedin descended the river in a Tibetan boat, and was cordially received at Shigatse by the Tashi lama. From the above it appears that the previous message (see p. 159) that Dr. Hedin reached Gyangtse on February 5 must have been an error.

The New Volcanic Island off Burma.—In connection with the Note on this island which appeared in our last issue (p. 206), it is of interest to note that a series of photographs of the island, taken on December 31, which show very clearly both the appearance of the island from a distance, and the nature of its surface at the time of the visit, appears in the April issue of the *Geographical Journal*.

POLAR.

The Wellman Polar Expedition.—A Reuter message states that before sailing for New York, Mr. Walter Wellman announced that he would again attempt to reach the North Pole by airship during the coming summer. The expedition steamer *Frithjof*, which is now at Trondhjem, is to be ready to leave Tromsø, with the expedition on board, for Spitsbergen on June 1. The party will consist of about thirty-five men, and will proceed at once to the expedition base at Dane's Island, established last year, where three men are now living. The balloon part of the airship *America* has been rebuilt. The proper speed of this airship is 16 to 18 statute miles per hour, and the fuel carried gives 150 hours of motoring at full speed; the radius of action is thus over 2250 miles, or nearly double the distance from Spitsbergen to the Pole and back again. All the mechanical part is being thoroughly tested by weeks of running, and at Spitsbergen trials will be made in the air of the completed ship before attempting the voyage to the Pole. In addition to motors, machinery, nearly three and a half tons of petrol, the crew of four or five men, a dozen sledge dogs and a completely equipped sledging party for a possible return over the ice in case of need, the *America* will carry a ton and a half of food, making it possible for the crew to spend the entire winter in the Arctic regions should that be necessary. It is planned to reach the expedition base at Spitsbergen in June, to have trials of the airship in July, and to start for the Pole in the latter part of that month, or in the first half of August.

New Belgian Antarctic Expedition.—According to a note in *Globus*, M. Henryk Arctowski's plans for a new Belgian expedition to the Antarctic region are well advanced, and are arousing much interest in Belgium. The region to which the expedition is to devote attention is that lying between the ground explored by the last Belgian expedition and

Edward VII. Land. The last expedition reached long. 102° W., and there is a vast extent of unexplored territory between this and the new land discovered by the *Discovery* expedition, which, it will be remembered, is in 152° W. If, as is expected, continental land is reached, it is hoped that this may be explored by the help of motor-car sledges, of whose use M. Arctowski has always been a strong advocate. The cost of the expedition is estimated at 800,000 francs (£32,000), and it is not certain whether it will be able to start this October or not.

GENERAL.

The Problem of the Return Trade-winds.—In connection with the account given in this *Magazine* (p. 116) by the Prince of Monaco of Professor Hergesell's observations and deductions on the subject of the anti-trades, it is of interest to note a paper by Mr. A. Lawrence Rotch (*Proc. Amer. Acad. Arts and Sci.*, xlii) on certain observations on the subject made during 1905 and 1906. The experiments were performed in the Atlantic from the steam-yacht *Otaria*, under the auspices of the author and of M. Teisserenc de Bort, and the results in this case, as contrasted with the *Princesse Alice* experiments, are to show the existence of anti-trade winds, which are south-west in the latitude of the Canaries, and south-east near the Cape Verde Islands, thus illustrating the effect of the earth's rotation. Further, a special investigation made in 1906 in the open ocean to the westward of the Canaries showed the presence of a south-westerly anti-trade extending upwards from a height of between 3000 and 4000 metres, and thus goes so far to disprove Professor Hergesell's suggestion that the south-west wind at the summit of the Peak of Teneriffe is a local phenomenon, and not, as was previously supposed, the true anti-trade. In other words, the result of the Rotch and Teisserenc de Bort expedition is to support the older view of the position of the return current against the negative position maintained by Professor Hergesell on the basis of the *Princesse Alice* experiments. The further investigation of the subject will be awaited with interest.

The Royal Geographical Society's Annual Awards.—With the approval of the King, the two Royal Medals have this year been awarded by the Council of the Royal Geographical Society—the Founder's to Dr. Francisco Moreno, and the Patron's to Dr. Roald Amundsen.

Dr. Moreno, who is an Argentine, is one of the foremost scientific geographers of the day. For more than twenty years he has been personally occupied in the work of South American exploration. Patagonia and the Southern Andes have been his peculiar field, and in the prosecution of his work he has encountered unusual risks. He was the expert employed by the Government of the Argentine Republic on the Chile-Argentina boundary question, and it is to him that we owe nearly all our knowledge of the physical geography of the extreme south of South America.

Captain Roald Amundsen, a distinguished Norwegian explorer, has, as is well known, only recently completed the North-West Passage for the first time in a ship. He served as first lieutenant on board the *Belgica* in the Belgian Antarctic Expedition. On his return he devoted himself to mastering the subject of terrestrial magnetism, placing himself under the tuition of Dr. von Neumayer, of the Hamburg Observatory, in order that he might qualify himself for his projected work around the North Magnetic Pole. After purchasing his ship, the *Gjøa*, he spent some time exploring the ocean between Spitsbergen and Greenland, making valuable contributions to oceanography which have since been worked out by Dr. Nansen. He sailed for the region around the North Magnetic Pole in 1903, in his tiny ship, with eight men all told, all of them more or less specialists. He devoted two years to careful observations with the best instruments around the North Magnetic Pole, making contributions of the first order to knowledge of the geographical distribution of magnetism. During the stay of the expedition in the neighbourhood of Boothia, several expeditions were made in various directions. A large section hitherto unmapped of the North American coast was mapped, and much other geographical work done in the neighbouring islands, and careful observations were made on the Eskimo, among whom the expedition lived.

Of the other honours which the Society has at its disposal, the Murchison Bequest has been awarded to Captain G. E. Smith for his various important surveys in British East Africa; the Gill Memorial to Mr. C. Raymond Beazly for his work in three volumes on *The Dawn of Modern Geography*, the result of many years' research; the Back Bequest to Mr. C. E. Moss for his important researches on the geographical distribution of vegetation in England; and the Cuthbert Peek Fund to Major C. W. Gwynn, C.M.G., D.S.O., R.E., for the important geographical and cartographical work which he carried out in the Blue Nile region and on the proposed Sudan-Abyssinian frontier.

The Scottish Meteorological Society.—The annual general meeting of this Society was held in Edinburgh on March 19, Professor Crum Brown presiding. The chairman pointed out the need for increasing the membership of the society, and for making the value of its work better known throughout Scotland. Subsequently papers were read by Dr. Buchan on "Thunderstorms in Scotland," and on "Variations in Mean Monthly Temperatures in Edinburgh" by Mr. R. T. Ormerod.

COMMERCIAL GEOGRAPHY.

New Railways in Switzerland.—According to the *Times*, several new railway schemes in connection with tourist resorts in Switzerland are in a more or less advanced condition. The Anniviers Valley Electrical Company has been authorised to construct a railway in four sections, from Sierre to Vissoye, from Vissoye to Zinal, from Zinal to Zermatt, with a branch from Vissoye to St. Luc. This line will yet

further diminish the number of tourist resorts without railway communication in Switzerland, and as regards the Zinal to Zermatt section at least seems a little unnecessary. This section is to cross *viâ* Mountet. Further, the concession for the long-talked of Matterhorn railway has now been applied for, though it is to be hoped that this wholly uncalled-for scheme will not be persisted in.

Another concession of much greater importance applied for is that for a railway from Coire to Chiavenna, which would tunnel through the Splügen. The main tunnel would be just under seventeen miles in length, of which somewhat more than half would be in Swiss territory and the remainder in Italian. The cost would be about five millions sterling, and the enterprise would, it is estimated, take some eight years to carry out. The total length of the line would be a little over fifty-two miles. It is stated that the Italian Government is in favour of the scheme, which has received extensive support.

EDUCATIONAL.

It is probable that the value of the study of the weather changes day by day as an introduction to geography and nature study is not so fully appreciated by teachers as it might be, while those teachers who are convinced of its value may perhaps welcome some account of the aids to its study in schools which are furnished by the publications of the Meteorological Office. It is hoped that a meeting for teachers and others interested in education may be held during the autumn in connection with the Society of Edinburgh, when a paper would be read on the value of meteorology as a part of geography, followed by a discussion on the subject. Meantime, examples of the Meteorological Office's publications have been laid on the library table for inspection by those interested. This office publishes weather reports in three forms. The *Daily* report is issued daily at 2 P.M., and is supplied post free for five shillings a quarter. Single copies can be obtained from the Meteorological Office, 63 Victoria Street, London, S.W., for the sum of one penny *plus* postage, while copies for class use can be obtained on giving notice at the rate of 6d. per ten copies. The daily report gives the observations of barometer, thermometer, wind, weather, etc., for the evening and morning preceding publication, with notes on foreign stations, etc., and, the feature of greatest value for teaching purposes, charts showing the pressure, temperature, etc., for the morning of the day of publication. With the opening of the new cable to Faeroe and Iceland it has been possible to extend the charts over a much larger part of the Atlantic than was formerly included, and as three barometric charts appear on the same sheet, it is possible to follow in the clearest and most satisfactory way the approach of barometric depressions from the west. For example, the charts for February 20 show very clearly the approach and path of the great storm which wrecked the *Berlin* the following day. It can hardly be questioned that in a sea-

faring nation the power to read such a chart should be in the possession of every school child. There can be little doubt also that the right method is to let the scholars make observations of their own for their own locality, and then by means of the weather charts let them see that the local changes are all part of a great cycle which is affecting the weather of the whole country.

The *Weekly* weather report is a quarto document of eight pages, which is sold at the price of 6d., and can be obtained singly from Messrs. Oliver and Boyd, Edinburgh, or can be obtained for an annual subscription of £1, 10s. post free. It contains a very large amount of information in regard to the meteorological conditions for the week, together with three charts, one of temperature and two showing wind and isobars for every day of the preceding week. These charts are reduced in size as compared with the daily charts, but there is of course a great educational advantage in being able to follow the changes simultaneously through a whole weekly period.

Finally, beginning with January of the present year, the Meteorological Office publishes a *Monthly* report, sold at the price of 6d. per single copy, or 6s. 6d. per annum post free, which gives a summary of the weather conditions during the month, and includes four maps showing the average conditions during the month. The first of these deals with pressure and wind, and compares the average for the particular month with the average for the same month during a thirty-five years' period. The second, a very interesting chart, shows the path of depressions during the month, while the remaining two illustrate temperature and rainfall.

On p. 102 we noted here an article by M. Mückel on "La Géographie de la Circulation." A second part of this article appears in the *Annales de Géographie* for January 15, and may be also recommended to the notice of teachers as full of interesting and suggestive points, and with many references which will be found useful to teachers. The present article is concerned with methods of communication on land, a subject which is exceptionally well suited for useful lessons. It treats of roads and paths, means of transport, animal and mechanical, and methods of transmitting information in their relation to geography, and, to a less extent, to history. That man is the dearest and least efficient of transport animals is well known, but it is interesting to note that his intelligence, prudence, and power of negotiating narrow and difficult passages make him an exceedingly useful one wherever the special conditions demand these qualities. The bearing of these facts on the evolution of the slave trade of Africa, for example, is a point of great interest, as is also the gradual replacement there of the porter by motor-car or railway train. But without stopping to mention in detail the numerous interesting matters with which the article deals, we may recommend to the notice of teachers the following dictum as one which it is important to impress in all its bearing upon their pupils:—"Circulation is a movement provoked by the variety of the resources of the globe, where nature has distributed unequally the sum total of

commodities and work among peoples and States. It is the local variety of nature which has created circulation, the means of obtaining economic equilibrium among peoples. . . . It is the principal agent in the development of States; it prepares the foundation of their power and is an essential element of their organisation; there is no State without an economic policy, however rudimentary."

NEW BOOKS.

ASIA.

The Passing of Korea. By HOMER R. HULBERT, A.M., F.R.G.S.
London: William Heinemann, 1906. Price 16s. net.

Since the days of the Russo-Japanese war we have had several books which have dealt more or less comprehensively with the Empire of Korea. The latest of these is the handsome and well-illustrated volume now before us from the capable pen of Mr. Homer R. Hulbert, the author of several well-known works, amongst others a *History of Korea*. This book seems to have been written in the first instance for the special enlightenment of the American public, but it will find, as it certainly deserves, a great number of interested readers on this side of the Atlantic. It purports to be a defence as well as a description and history of the Koreans, and the author is indignant and sore that one result of the Russo-Japanese war has been the loss of the independence of Korea and its practical subjugation by Japan. He hardly disguises his distrust and dislike of our Eastern ally, although he cannot but admit her military prowess and marvellous advance in the arts and sciences of peace. He wisely refrains from prophecy, and contents himself with saying that "it is difficult to foresee what the resultant civilisation of Japan will be. There is nothing final as yet, nor have the conflicting forces indicated along what definite lines the intense nationalism of the Japanese will develop."

With every desire and intention to show us the best side of the Koreans, Mr. Hulbert has, we fear, been too honest and truthful in his descriptions of the Korean court and people. Take for example the important matter of religion. Of this Mr. Hulbert points out that so long ago as the sixth and seventh centuries, Korea became "the slave of Chinese thought. She lost all spontaneity and originality. To imitate became her highest ambition, and she lost sight of all beyond this contracted horizon. Intrinsically and potentially the Korean is a man of high intellectual possibilities, but he is, superficially, what he is by virtue of his training and education. Take him out of this environment, and give him a chance to develop independently and naturally, and you would have as good a brain as the Far East has to offer." But it seems to us that what has happened is precisely what Mr. Hulbert here desiderates. Korea under the stimulus of Japanese civilisation will be taken out of its time-worn environment, and will get a chance of development such as has never occurred hitherto in its history. The conservatism and backwardness of the Koreans as described by Mr. Hulbert are phenomenal. What are we to think of a nation which up to thirty years ago confined itself to the use of flint and steel, declined to use petroleum, sewing-needles, thread, soap, and a thousand other articles of daily use, and where "every man was obliged to carry on his person a small piece of wood on which were written his name, the year of his birth, and his rank. Any one who failed to carry this

tag was considered an outlaw." The Korean as depicted by Mr. Hulbert is excessively proud and improvident, lavish of his own money when he has any, and with that of others when he has none of his own; he sees "about as much moral turpitude in a lie as we see in a mixed metaphor or a split infinitive"; his language when angry is unspeakably filthy and gross, and his conduct like that of an insane person or "of a fanged beast"; he is utterly callous to the sufferings of animals: *per contra*, he is hospitable when he has the means of being so. The system of Government as described by Mr. Hulbert evokes wonder that any nation, however submissive, could tolerate it for half a dozen years; and his graphic descriptions of the procedure of the so-called Courts of Justice are equally astounding. Blackmail, it seems, is a fine art, and is practised in all walks of life. With regard to means of communication, there are now a few miles of railway in Korea, but by far the greater part of the roads throughout the Empire are mere bridle-paths, fit only for the use of bullocks, ponies, and men; and Mr. Hulbert is of opinion that "more dead weight is carried on men's backs than on those of bullocks and horses combined." The only important industries in Korea are agriculture, fishing, and mining. In literature the Korean is as conservative and backward as he is in other things. "Imitation of past writings is the highest excellence to be achieved. Not only is there no such thing as originality, but the very word itself is wanting." There is, strange to say, an encyclopædia in a hundred and twelve volumes, and there are a few somewhat disreputable novels. Education is confined to Chinese classics, and in each village is conducted "in a little room in a private house where the boys sit on the floor with their large print-books of Chinese character before them, and as they sway back and forth with half-shut eyes, they drone out the sounds of the ideographs, not in unison, but each for himself. There is no such thing as a class, for no two of the boys are together." The petty sum of twenty thousand dollars is all that the State expends on education. With regard to the position of women in Korea, Mr. Hulbert judiciously remarks that "under existing moral conditions the seclusion of women in the Far East is a blessing and not a curse, and its immediate abolishment would result in a moral chaos rather than, as some suppose, in the elevation of society."

The description we have thus given of the Koreans is practically that of Mr. Hulbert, and taking him at his own word the inference seems inevitable, "that the Korean people are a degenerate and contemptible nation, incapable of better things, intellectually inferior, and better off under Japanese rule than independent." But as a matter of fact, Korea has not yet been annexed; it has merely been brought within the sphere of Japan's influence and taken under her protection; and it lies within her own power to profit by the proximity of a civilisation which is far beyond what she has ever dreamed of.

It is very obvious that Mr. Hulbert is profoundly indignant at and resentful of the treatment of Korea by the United States of America. "If there is any nation on earth," he says, "that deserves the active and substantial aid of the American people, that nation is Korea. . . . But when the time of difficulty approached and America's disinterested friendship was to be called upon to prove the genuineness of its oft-repeated protestations, we deserted her with such celerity, such cold-heartedness, and such a refinement of contempt, that the blood of every decent American citizen in Korea boiled with indignation. While the most loyal, cultured and patriotic Koreans were committing suicide one after the other, because they could not survive the death of their country, the American Minister was toasting the perpetrators of the outrage in bumpers of champagne; utterly callous to the death-throes of an Empire which had treated American

citizens with a courtesy and consideration they had enjoyed in no other Oriental country." But however it may have come about, we are convinced that the present condition and prospects of Korea in no way warrant any gloomy prognostications as to its future; on the contrary, they are more healthy and hopeful than they have ever been since Korea first merged from obscurity into the light of history in the days of Kija, who, it is said, flourished before the reign of David in Jerusalem.

We cordially recommend this valuable and exhaustive work to our readers. Mr. Hulbert is master of an easy and perspicuous style, and it is very evident that he has made a profound and sympathetic study of Korea and its people, but this has not prevented his observing and recording the many and grave defects and faults in their character. His chapters on the folklore, religion, superstition and burial customs of Korea are very interesting and instructive, and some of his translations of Korean poetry are graceful and melodious.

The Todas. By W. H. R. RIVERS, Fellow of St. John's College, Cambridge. With Illustrations. London: Macmillan and Co., 1906. Price 21s. net.

It does not often happen in this country that a man enters upon the anthropological examination of a primitive people like the Todas so well equipped by previous experience for the task as Mr. W. Rivers. He formed one of the members of the Cambridge expedition in charge of Dr. Haddon, sent out a few years ago to investigate the tribes of New Guinea and the islands of the Torres Straits. He was therefore well qualified to gather information, down to the minutest particulars, concerning the social organisation, the daily life, the religion, the myths, the ceremonies performed at birth, marriage and death, etc., of the Todas. The result is a stout volume, sufficiently illustrated, that may be placed in the same category as the two important works of Messrs. Spencer and Gillen on the native tribes of Central Australia, to which volumes it forms a worthy pendant.

The Todas who now inhabit the Nilgiri Hills are grouped round the hill-station of Ootacamund in the Madras Presidency and have excited the interest and curiosity of many visitors to this sanatorium. They differ in appearance from other natives of Southern India, being lighter in colour, so that some writers have supposed them to be of Aryan or Caucasian origin. They are divided into two endogamous divisions, each of which is sub-divided into smaller exogamous septs. What distinguishes the Todas pre-eminently from other peoples is their cult of the cow buffalo, for they pay no attention to the bull, who does not even receive a name. The basis of the greater part of the ritual of the Todas consists in the milking and churning at the dairies, which may really be regarded as temples. These are held so sacred that the author was never allowed to enter within the walls enclosing the dairy, still less to enter the building itself. Save at appointed times women are also excluded from the precincts of the dairy. A certain amount of sanctity is attached to the head dairymen, and to attain this dignity, which in these degenerate days is not coveted, he must undergo a ceremony of initiation, the central feature of which is purification, and lead a life entailing considerable privation during the few years he holds office. He must be celibate and leave his wife; he may not go home or visit the bazaar or attend funerals, and he must never be touched by an ordinary man.

The gods of the Todas are thought of as invisible and inhabiting the hilltops, but in other respects they are human, for each has his own dairies and buffaloes. They seem to be a development of hill-spirits, and there is little to show that ancestor worship has played any part in the evolution of their religion or that gods

are personifications of the forces of Nature. Sometimes a hero might be raised to the dignity of a god. Kwoto, for instance, was of human parentage, but aspired to belong to the society of gods. After giving proof of his strength before the gods, they asked him if he could tie the sun with a stone chain. Forthwith Kwoto put a stone-chain round the sun and hauled it down to the ground, and as it was thirsty he took it to a stream to allow it to drink. After such an exhibition of his power Kwoto was acknowledged to be the mightiest of the gods.

The magic beliefs of the Todas, their methods of divination, and the character of their spells for curing disease, are much on the same lines as those of other people on a similar plane of civilisation. As regards funeral rites, they practise cremation, and the funeral ceremonies are sometimes prolonged for months. One of the ceremonies, that of "earth throwing," may possibly mean that inhumation was the funeral rite formerly, and that cremation is of more recent origin. Buffaloes are sacrificed on these occasions; yet the Todas do not eat the flesh but give it to the Kotas, another hill-tribe of different origin, who supply the Todas with earthenware and other objects they cannot manufacture for themselves. Before the corpse is burnt all the ornaments with which it was adorned are removed—a practice which does not prevent the people from believing that the deceased is not thereby deprived of these objects in the other world. This world of the dead is supposed to lie to the west and to be illumined by the same sun as ours. The sun is an object of reverence, and every man on leaving his hut in the morning is careful to salute it with a special gesture. But no reverence seems to be paid to fire or to the moon, and there is no evidence of phallic worship.

The Todas have the classificatory system of kinship and practice polyandry, usually fraternal. When a woman marries a man she becomes the wife of all his brothers. A man can and ought to marry the daughter of his maternal uncle or of his paternal aunt, but he may not marry the daughter of his paternal uncles or of his maternal aunts. The rule that a man must take a wife from a clan different from his own partly accounts for these prohibitions.

In the last chapter the author discusses the possible origin of the Todas. He is inclined to believe that they came to the Nilgiri Hills from Malabar. The head-measurements of the Todas correspond very closely with those of the Nairs, who also practise fraternal polyandry and whose social and religious customs closely resemble those of the Todas. The Toda language appears to be much like Malayalam, so that there is a good deal to be said for the author's opinion. Yet the Todas can only be derived from any of the Malabar races on the supposition that the migration took place a very long time ago.

In the appendix will be found 72 genealogical tables in which the genealogy of 736 persons, or nearly the whole existing Toda population, is carried back for three or four generations. The work and the toil involved in preparing this almost novel method of research must have been immense.

My Pilgrimage to the Wise Men of the East. By MONCURE D. CONWAY.

Archibald Constable and Co., Ltd., 1906. Price 12s. 6d. net.

The first impression which the reader has, is that this is not a book of travel in the ordinary sense, nor of immediate interest to the geographer. Indeed Mr. Conway frankly says that he is not so much impressed with scenery and places as with his fellow-creatures. As the reader advances through the volume, he realises that he has before him a document of considerable interest to the student of religion, for the author has used the occasion to pass in review the religious experiences of his life. The *Pilgrimage* will chiefly appeal to those

who are drawn to the form of belief of which Moncure Conway is one of the foremost exponents, but even those who do not like either his views or methods, will find a certain element of pathos in these pages. For in the foreword he relates how he first came to study the religions of the East by having put into his hands the translation by Wilkins of the Bhagavat Gita, and how he was affected by the wonderful dialogue of Krishna and Arjuna. Then, as he relates, came his opportunity, in 1882, when he was enabled to go round the world and meet face to face with the followers of the old religions. Hence this work. In it we have an account of the many interesting men and women he met, not to speak of the numberless cranks of all sorts from Arabi to Madame Blavatsky.

We may doubt very much whether he gained greatly by his personal intercourse with the Hindu. He seemed to travel with a mind eager to accept anything antagonistic to the religion in which he was reared, and it would be strange if he were not indulged to the top of his bent.

We are glad to see that Mr. Conway renders full justice to the catholic spirit in which the British Government fulfils its great responsibilities.

Under the Sun. By PERCEVAL LANDON. London: Hurst and Blackett, Limited, 1906. Price 12s. 6d. net.

In this work the reader has a series of brightly written sketches, describing over a score of the well-known cities of India. The subject is somewhat hackneyed now, but the interest attached to our Indian Empire is perennial, and Mr. Landon's work is sure to find acceptance with a large body of readers. It is to be followed by another work, dealing in a similar way with some of the towns which are not so well known. The book is embellished with some excellent photographs.

Tamil Grammar Self-Taught. By DON M. DE ZILVA WICKREMASINGHE. London: Marlborough and Co., 1906. Price 5s.

This useful little volume is a valuable addition to the series of which it forms a member. As it informs us, the Tamil language is spoken by more than sixteen millions of people in India and Northern Ceylon, in addition to the large Tamil communities in the tea plantations of Burma, Straits Settlements, etc., so that the grammar should be of interest to not a few persons in this country.

The First Expedition of the Portuguese to Banda. By JAMES ROXBURGH M'Clymont, M.A. Hobart: Privately printed, 1905.

Mr. M'Clymont has given a very interesting account of one of Albuquerque's great achievements. In order to "place" this particular expedition, the reader may be referred to Sir W. W. Hunter's *History of British India*. It was war to the knife between Islam and Christendom; and in order to cripple the Mohammedan trade with the Far East, Albuquerque's scheme was to occupy three main points of control, at Ormuz, at Goa, and Malacca; and it was in pursuance of this plan that he undertook and carried out the expedition.

Mr. M'Clymont fills in from original sources many details which are barely touched upon by Hunter, and shows how, after reducing Malacca, the great admiral sailed round the coast of Java, and finally landed at Banda.

We welcome this careful monograph dealing with a period of history which is almost without parallel, and yet which is only very imperfectly known.

Lotus Land: Being an Account of the Country and the People of Southern Siam.

By P. A. THOMPSON, B.A. A.M.I.C.E. etc. London: T. Werner Laurie, 1906. Price 16s. net.

This book is a solid and most satisfactory piece of work. After giving an interesting historical sketch of the history of Siam in the introduction, the author, who has resided for three years amongst the peasantry there, presents for our edification a lucid and graphic description of the country and its inhabitants, art, religion and conditions of life. He has, however, omitted all tales of adventure or any account of the rulers of Siam.

In the introduction Mr. Thompson has sought with success to reconcile the conflicting statements of his authorities, and urges Europeans living in the country still further to clear up many points not yet elucidated. We trust that his request will be acceded to.

The excellent illustrations from photographs by the author are a noteworthy feature in the book. His description of Bangkok is lively, vivid and sympathetic withal; it shows an accurate and comprehensive observation, as does the whole volume.

The Siamese have a great reverence for authority, and this may explain why Europeans have found it so easy to deal with those placed under their rule. Still they are not servile, and, while perfectly polite, speak to Europeans as one free man to another. Good subordinates, they do not show much administrative ability, and hence European advisers are employed together with Americans. The general adviser to the Government at present is an American; railways, postal arrangements and the telegraph system are under Germans; the navy and the gendarmerie under Danes; public works are superintended by Italians, and Frenchmen rule the sanitation; Belgians look after justice and finance, while customs, education, mining and survey are officered by the British: truly an international pot-pourri, but it seems to work well. The Buddhist religion is well and sympathetically described; the Buddhist attitude towards warring sects is thus described: "A company of blind men were once walking along a road when it chanced that they met an elephant. Each felt the animal, and then they fell to discussing what it was that they had met. One had felt only the tusk, and he said it was something round and smooth; another had felt the ear, and he said it was something large and flat; a third had felt a leg and he declared it was like the trunk of a tree, while a fourth who had felt the tail said that it was a rope. Soon they began to quarrel over it and then from words they proceeded to blows, but a certain sage who had witnessed the occurrence stopped them and said, 'Had you but pieced together the facts you each perceived, you would, amongst you, have arrived at the truth.'"

The temples, symbols, and brotherhood of the yellow robe are well described. Siamese art is studied with care, and we can promise our readers much pleasure and instruction from the volume as a whole. We do not often get such a satisfactory book to review.

AFRICA.

A Travers l'Afrique Centrale (Tra Mez-Afriko). Conférence avec projections donnée au 2^me Congrès Universel d'Esperanto à Genève, 1^{er} Septembre 1906. Par Le Commandant LEMAIRE, Ch. Bruges: A. S. Witteryck, Éditeur.

This is an illustrated report of an address delivered by Commandant Lemaire, printed in French and Esperanto, the pages being so arranged as to facilitate the

learning of Esperanto by any one familiar with French. The address, which gives a popular account of Commandant Lemaire's crossing of Africa, is extremely fresh and interesting, and we recommend the pamphlet to the notice of all interested alike in geography and Esperanto.

In the same connection we may note that we have also received a communication from the "Delegation for the adoption of an International Auxiliary Language" in connection with the Third Universal Congress of Esperantists, to be held at Cambridge this August.

Uganda by Pen and Camera. By C. W. HATTERSLEY. London : Religious Tract Society, 1906. Price 2s.

This little book, which is written in a somewhat artless style, is chiefly of value to those who are interested in mission work in Uganda, but incidentally gives some information as to the scenery and people of Uganda, and of those met with on the journey thither from Mombasa. The book is illustrated by numerous photographs, and indicates clearly the progress which has been recently made in Uganda.

Wisa Handbook: A Short Introduction to the Wisa Dialect of North-East Rhodesia. By A. C. MADAN. Oxford : Clarendon Press, 1906. Price 3s.

We published here recently an appeal from the author of this book for information in regard to the languages of the Bantu races. In the preface to the present handbook of the hitherto little-known Wisa dialect, he points out that it has all the characteristic grammatical peculiarities of the Bantu type. The language is spoken not only by the Wisas, but in a slightly modified form also by the Lalas, who live between the Loangwa and the Kafue rivers in about 29° to 30° E. long., and 14° S. lat. Besides an account of the language, the handbook contains in an appendix two Wisa stories, with translation and notes, and should be very useful to students.

The Egypt of the Future. By EDWARD DICEY, C.B. London : William Heinemann, 1907. Pp. 216. Price 3s. 6d. net.

Mr. Dicey is so well known as a writer upon things Egyptian that anything from his vigorous pen is sure to be widely read, and whatever view may be taken of the main contention of this book, it is at any rate informative and eminently readable. In Mr. Dicey's opinion the true policy of this country towards Egypt is at once to regularise our position by declaring the country a British Protectorate, taking over the Public Debt, abolishing the Capitulations and Mixed Courts, and then reforming the administration in various ways, notably by a far larger employment of native officials. He holds that the present anomalous position lays us open at any time to that demand for International Control, as opposed to the "free hand," which Germany asserted and established in the case of Morocco. Moreover, he says there is a steadily growing obstacle in the form of passive resistance from the Egyptians themselves, due to the spread of native newspapers, ill-digested education, and the Pan-Islamic movement. The official view that the Fellahs recognise so fully the advantages which have accrued to them under our rule that they desire nothing better than its continuance, is scouted by Mr. Dicey. Gratitude among Orientals occupies a small place compared to creed. A further plea for action is that ere long in his view the break-up of the Turkish Empire must occur, and the whole question of Egypt and our position there will be forced immediately upon the attention of other countries. It is better to strike

now. That we must in some form retain and strengthen our hold upon Egypt for the sake of our Indian Empire is a point upon which Mr. Dicey has no doubts whatever.

The book contains a very frank criticism of Lord Cromer's policy of administration, which the writer holds to be conducted for the benefit of England first and of Egypt only in the second place, to be out of touch with native feeling, and too autocratic. He admits at the same time that the country has throughout its history been ruled by a succession of despots, and that the late Consul-General was as good an absolute ruler as Egypt has ever possessed. But he declares his preference for the policy advocated by Lord Dufferin—that adopted in the Native States of India and elsewhere—under which supreme authority is vested in the representative of the Protecting Power, native administrators are employed as fully as is possible, and while considerable latitude is allowed them as to their methods, they are sternly punished in the case of any gross abuse or scandal.

Our impression is, that although some readers will adopt the view on behalf of which Mr. Dicey has issued this book, the majority, especially in view of the difficulties which he so ably expounds, will not support his advocacy of a *coup d'état*, but will rather adhere to the policy attributed to Lord Cromer which is described as going on as we are until some fine day the world discovers that we have established a Protectorate without anybody knowing that we have done so. We may note that the book was published before the issue of Lord Cromer's 1906 Report, in which his legislative proposals are further developed. In any case the book, which we understand was at once translated into Arabic, is sure of a large circle of readers.

We are glad to note, for little credit is given nowadays to the possibility of friendly action on the part of Germany, that Mr. Dicey attributes to her intervention at Constantinople the collapse of the recent Akabah incident.

AMERICA.

Canada To-day. By J. A. HOBSON, M.A. London: T. Fisher Unwin, 1906.
Price 3s. 6d. net.

In the winter of 1905-6 Mr. Hobson, a convinced free-trader, contributed a series of letters to the *Daily Chronicle* setting forth his impressions on the subject of Free Trade *versus* Protection with special reference to Canada and the United States. These letters are rewritten and republished with a number of corrections and additions in the volume now before us. Incidentally we got some information as to the progress, resources and conditions of Canada of the present day.

GENERAL.

Hints to Travellers: Scientific and General. Edited for the Council of the Royal Geographical Society by G. A. REEVES, F.R.A.S., F.R.G.S. Ninth Edition, revised and enlarged. 2 vols. Price 15s. net. London: The Royal Geographical Society.

The Royal Geographical Society must be heartily congratulated on the new edition of these valuable volumes, *Hints to Travellers*, and more particularly must congratulations be given to Mr. Reeves, the able editor, to whom is due the thanks of all geographers, and especially all practical travellers and explorers. In a wonderful way he has compressed into these two volumes practically everything that is necessary for intending explorers, and the size and general arrangement of these books make them a valuable *vade mecum* for explorers in the field.

One particularly notices the additions to the ninth edition, which has been brought up to date in a way that leaves nothing to be desired.

Looking through the first volume, one notices certain additions which we feel ought to be briefly mentioned in this article. The section entitled "Introductory Remarks" serves as a general guide to survey work to be undertaken, the methods to follow, the instruments to use, so that the geographical surveyor may follow the most accurate method for work under whatever circumstances he may be placed. The need of this particular section has long been felt, and we are glad to see that Mr. Reeves has included it in this edition. The outfit list has been considerably altered, and an approximate price-list of instruments has been added, which will guide intending travellers when contemplating any expedition, and give them a reliable figure to base their calculation of cost upon.

In Part II. we notice that the theodolite has received more adequate notice, and the small 4" transit theodolite which has been specially designed by Mr. Reeves for travellers, to whom weight is a great consideration, is, from what we know of the subject, a vast improvement. It is fitted with Mr. Reeves's tangent micrometer, which enables readings to be taken with great accuracy. This, we believe, is the first published description of this micrometer and theodolite, and from information received from surveyors who work with this instrument, it leaves nothing to be desired. We also notice that the mathematical principle of the sextant is given for the first time in this work.

The Editor seems to be of the opinion that Captain George's Mercurial Barometer, the description of which was left out of the last edition but is now reinserted, is the best class of barometer for a traveller to take, owing to the tubes being carried empty.

From pages 86 to 93 a special new section of sketches and projections of maps, and a complete example of a projection (Survey of India Projection), is inserted.

Part IV. is entitled Geographical Surveying and Mapping, and nearly the whole of this important section is entirely new to the book, and contains much information. It gives descriptions of base measurements, interpolation of points, a complete example of theodolite traversing, reduction to centre, accurate methods of computing geodetic distances, latitudes, longitudes, and azimuths, route surveying with example of field-book; a complete chapter on determination of height by levelling, theodolite vertical angles, barometer and boiling point, and an example of contouring. The photographic surveying section has been rewritten and made more general, hints being given on making use of ordinary photographs in surveying. At the end of this section methods of adjusting theodolite angles are briefly given.

In Part V., Astronomical Observations, we note that for the first time this section is prefaced by the definitions of practical astronomy, which must be of considerable assistance to beginners; then follow examples of astronomical observations for latitude, time, longitude, and azimuths. The most important feature of this is that many of them are taken with the transit theodolite, which is certainly the instrument for land surveying. The formula employed in each case is also set, which was never done before, so that one need not work mechanically.

We also note that at the end of the volume many new and important tables have been added. In volume II. much has been done to bring it up to date, but the changes in this volume are nothing compared with those in the first volume.

Mr. Reeves is indeed to be congratulated on an accurate, painstaking, and excellent work, much of which is original, but he fully acknowledges in the preface his indebtedness to many other gentlemen who assisted him.

The Science Year-Book and Diary for 1907. Edited by Major B. F. S. BADEN-POWELL. London: King, Sell, and Olding. Price 5s.

We published a somewhat lengthy review of this annual last year, so that it is only necessary to say that the alterations in the present issue are not numerous. The Report of Scientific Progress has been modified, but still shows need of improvement. We notice that in the article Natural History text headings which must have been present in the MS. have been omitted by the compositors, with very bizarre results, as for example, the implied inclusion of the tsetse-fly among the nudibranch molluscs! Throughout the articles also adjectives are employed with a profusion which suggests log-rolling, and is certainly inelegant; thus a British Association address is described as "extremely fascinating." We have noticed a large number of serious misprints.

The World of To-Day. Vol. vi. By A. R. HOPE MONCRIEFF. London: Gresham Publishing Company, 1906. Pp. 380. Numerous illustrations. Price 8s. net.

This is the concluding volume of a notable series, produced too within a short space of time, if one considers the all-world area which is comprised, and the excellence of the workmanship. To include in the survey of this one volume, as he does, the United States, Canada, Arctic America, and all Europe, has demanded from the author a greater power of compression than was required in the other volumes. But his writing never fails to be free and interesting and informative. The illustrations as hitherto are well selected and well reproduced, and the comprehensive index deserves mention. We congratulate Mr. Hope Moncrieff on having made in this series a distinguished addition to the long list of excellent works which already stands to his credit.

NEW MAPS.

EUROPE.

ORDNANCE SURVEY OF SCOTLAND.—The following publications were issued from 1st to 28th February 1907:—One-inch Map (third edition), engraved, in outline. Sheets 28, 51. Price 1s. 6d. each.

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1:2500 Scale Maps (Revised), with Houses stippled, and with Areas. Price 3s. each. *Edinburghshire*.—Sheets vi. 1, 3, 5, 7, 10, 11, 13, 15, 16; xi. 4; xii. 2, 3, 5. Sheet ii. 3. Price 1s. 6d.

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The following publications were issued from 1st to 31st March 1907:—One-inch Map (third edition), engraved, with Hills in Brown or Black. Sheets 28, 51. Price 1s. 6d. each.

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54, 55, 64, 65, 66, 77, 88, 89, 99, 100, 101. Price 2s. 6d. each. Sheets 67, 79. Price 2s. each. *Sutherland*.—Sheets 108, 112. Price 2s. 6d. each. Without contours. *Ross and Cromarty*.—Sheets 11A, 18, 29, 39, 53. Price 2s. 6d. each. *Sutherland*.—Sheets, 102, 103. Price 2s. 6d. each. Sheet 113. Price 2s.

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GEOLOGICAL SURVEY OF SCOTLAND.—The following publications were issued from 1st to 31st March 1907 :—Four miles to one inch, colour printed. Sheets 16, 17. Price 2s. 6d. each.

ADMIRALTY CHART, SCOTLAND.—Ports in the Shetland Islands : Balta Harbour. Surveyed by Lieut. C. C. Bell, R.N., 1906. Scale 1 : 6900. Published Jan. 1907. Number 3643 (3657). Price 2s. *Admiralty Office, London.*

CHANNEL ISLANDS.—Bartholomew's Reduced Survey Maps of the ——. 1907. Jersey on scale of $1\frac{1}{2}$ inches to mile, Guernsey $1\frac{3}{4}$ to mile, Sark 2 inches to mile. Price 1s., or mounted on cloth in case 2s.

John Bartholomew and Co., Edinburgh.

A sheet of maps specially prepared for the use of tourists in the Channel Islands.

TURKEY.—Environs of Adrianople. Scale 1 : 250,000 or about 4 miles to an inch. Sept. 1906. Price 2s. 6d.

Topographical Section, General Staff, London.

RUSSIA.—Caucasia. Scale 1 : 2,027,520 or 32 miles to an inch. 1906.

Topographical Survey, General Staff, London.

AFRICA.

ANGLO-PORTUGUESE BOUNDARY North and South of the Zambesi. Map in 7 sheets. Scale 1 : 250,000 or about 4 miles to an inch. Nov. 1906.

Topographical Section, General Staff, London.

GAMBIA.—Reproduced from the work of the Anglo-French Boundary Commission, 1904-1905. Scale 1 : 250,000 or about 4 miles to an inch. 2 sheets. 1906. Price 2s. each sheet.

Topographical Section, General Staff, London.

GERMAN SOUTH-WEST AFRICA.—Scale 1 : 3,000,000 or about 50 miles to an inch. Dec. 1906.

Topographical Section, General Staff, London.

GOLD COAST.—General Staff Map on Scale of 1 : 1,000,000. Parts of Sheets 60, 72, and 73. 1906. In 2 sheets. Price 2s. each sheet.

SOMALILAND.—Map of Portion of ——. General Staff Map on Scale of 1 : 1,000,000. 1906.

Topographical Section, General Staff, London.

SOMALILAND.—General Staff Map on Scale of 1 : 250,000 or about 4 miles to an inch. Sheets 68-I, 68-J, 86-B, 86-F. 1905. Price 1s. 6d. each sheet.

Topographical Section, General Staff, London.

SOUTHERN NIGERIA AND KAMERUNS.—Map of Boundary between ——. 1905-6. Scale 1 : 100,000. In two sheets.

Topographical Section, General Staff, London.

WALFISCH BAY.—General Staff Map on Scale of 1 : 1,000,000. Sheet 119. 1906. Price 2s.

Topographical Section, General Staff, London.

AMERICA.

NORTH AMERICA.—Stanford's New Orographical Map of North America. Compiled under the direction of H. J. Mackinder, M.A. Scale 1:6,013,500. In four sheets. 1907. Price 16s. or 20s. mounted on rollers and varnished.

Edward Stanford, London.

This is the latest addition to Mr. Stanford's excellent series of Physical Wall Maps. The relief of the land surface is effectively shown in shades of brown, and the ocean depths in shades of blue. The lettering also includes political names.

CANADA.—Ontario, Welland Sheet, Topographic Map. Scale 1:63,360 or 1 inch to 1 mile. Department of Militia and Defence, 1907.

Topographical Section, General Staff, London.

CANADA, GEOLOGICAL SURVEY.—Nova Scotia. Scale 1:63,360 or 1 inch to 1 mile. Sheets 59, 60, 61, 62, 63, 64, 65, 74, 75, 76, 82, 83. Robert Bell, D.Sc., LL.D., etc., Acting Director of Survey. 1905. Price 10 cents each sheet.

Geological Survey of Canada, Ottawa.

ATLASES.

PHILIP'S HANDY VOLUME ATLAS of the World, with Statistical Notes and Index, by E. G. Ravenstein, F.R.G.S. Seventh edition, revised to date. 1907. Price 3s. 6d.

George Philip and Son, Limited, London.

The new edition of this useful and popular little atlas appears to be carefully revised to date.

ATLAS OF THE WORLD'S COMMERCE.—A new series of maps with descriptive text and diagrams showing Products, Imports and Exports, Commercial Conditions and Economic Statistics of the Countries of the World. Compiled from the latest official returns at the Edinburgh Geographical Institute, and edited by J. G. Bartholomew, F.R.S.E. 1907. Parts 17, 18, 19, 20, 21, and 22, completing the atlas. Price 6d. each part.

George Newnes, Limited, London.

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Panama: the Isthmus and Canal. By C. H. FORBES-LINDSAY. Illustrated. Crown 8vo. Pp. 384. Price \$1 net. The John C. Winston Company, Philadelphia, 1906.

Southern France and Corsica: Handbook for Travellers. By KARL BAEDEKER. Fifth Edition. Price 9 marks. Leipzig, 1907.

The Real Australia. By ALFRED BUCHANAN. Large crown 8vo. Pp. vii + 318. Price 6s. T. Fisher Unwin, London, 1907.

Natives of Northern India. By W. CROOKE, B.A. ("The Native Races of the British Empire.") Demy 8vo. Pp. xiv + 270. Price 6s. net. Archibald Constable, London, 1907.

First Steps in Geography. By ALEXIS EVERETT FRYE. Large 4to. Pp. viii + 170. Ginn and Company, Boston, 1907.

On the Mexican Highlands, with a Passing Glimpse of Cuba. By WILLIAM SEYMOUR EDWARDS. Demy 8vo. Pp. 283. Price \$1.50 net. Jennings and Graham, Cincinnati, 1906.

Sunny Singapore: an Account of the Place and its People, with a Sketch of the Results of Missionary Work. By the Rev. J. A. BETHUNE COOK. Crown 8vo. Price 5s. net. Pp. xiii + 158. Elliot Stock, London, 1907.

The Future of Japan, with a Survey of Present Conditions. By W. PETRIE WATSON. Crown 8vo. Pp. xxxi + 389. Price 10s. 6d. net. Duckworth and Co., London, 1907.

A Historical Geography of the British Colonies. Volume VI., Australasia. By J. D. ROGERS. With Maps. Crown 8vo. Pp. xii + 440. Price 7s. 6d. Clarendon Press, Oxford, 1907.

The "Queen" Newspaper Book of Travel: A Guide to Home and Foreign Resorts. Compiled by the Travel Editor (M. Hornsby, F.R.G.S.). Fourth year. Pp. 530. Price 2s. 6d. Horace Cox, London, 1907.

The Montreux-Bernese Oberland Railway, via the Simmenthal. Descriptive Notice by ALFRED CERESOLE. Illustrated. (Illustrated Europe Guide Books.) Cr. 8vo. Pp. 76. Price 1.50 fr. Art Institut, Orell Füssli, Zürich, 1907.

Also the following Reports, etc.:—

Northern Waters: Captain Roald Amundsen's Oceanographic Observations in the Arctic Seas in 1901, with a Discussion of the Origin of the Bottom Waters of the Northern Seas. By FRIDTJOF NANSEN. Christiania, 1906.

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British Central Africa (Nyasaland) Diary, 1907, with Handbook on the Protectorate compiled in the Secretary's Office from Information received from Various Sources. Price 3s. 6d. net. Zomba, B.C.A., 1907.

Annual Report of the Smithsonian Institution for the Years 1905, 1906. Two Volumes. Washington, 1906.

Guide-Annuaire de Madagascar et Dépendances. Années 1906-1907. Pp. 487. Tananarive, 1907.

Second Report (Northern Area) on Fishery and Hydrographical Investigations in the North Sea and Adjacent Waters, 1904-1905. Part I., Hydrography. London, 1907.

Handbook for East Africa, Uganda and Zanzibar, 1907. Crown 8vo. Pp. 300. Price 2s. Government Printing Press, Mombasa, 1907.

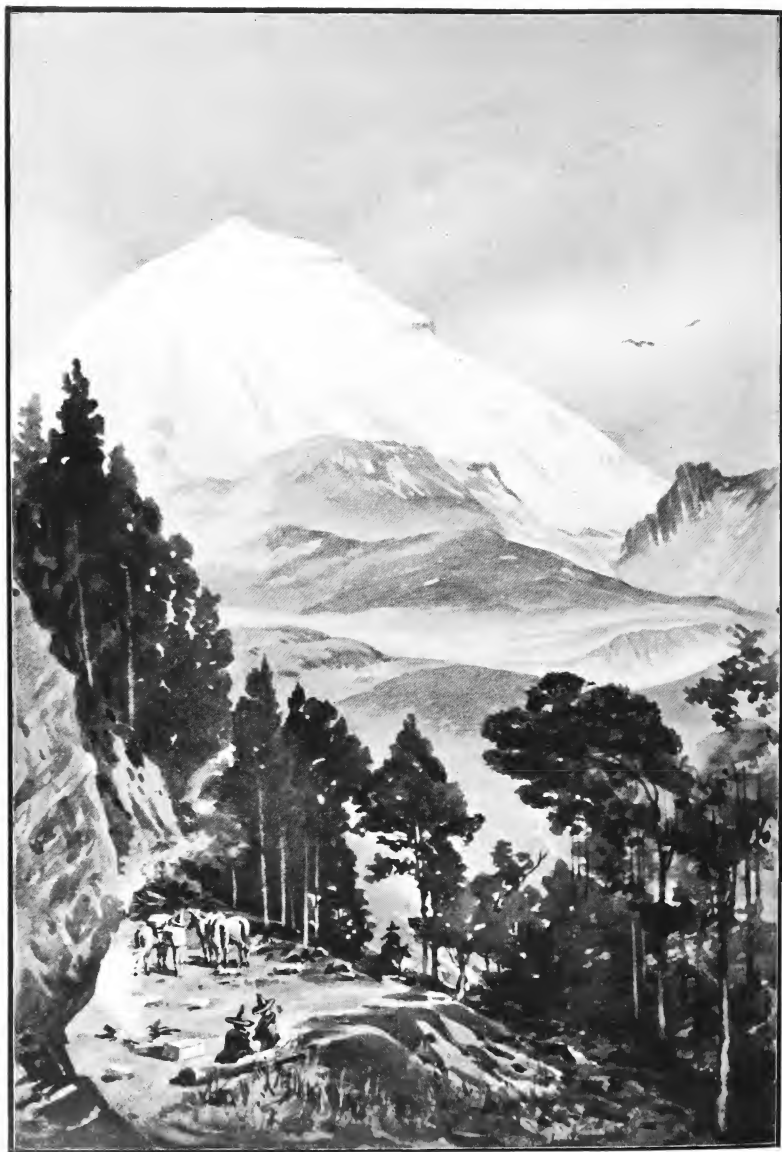
Report of the British Association for the Advancement of Science, York, 1906. John Murray, London, 1907.

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Survey of Tides and Currents in Canadian Waters. By W. BELL DAWSON, C.E. Ottawa, 1907.

Report on the Administration of the United Provinces of Agra and Oudh, 1905-1906. Allahabad, 1907.

Publishers forwarding books for review will greatly oblige by marking the price in clear figures, especially in the case of foreign books.



Frontispiece.

FIG. 1.—Citlaltepētl or Peak of Orizaba, 18,206 feet, looking northwards from camp at the cave 13,500 feet above sea. (Drawn by G. Straton Ferrier, R.I., after sketch by Author.)

THE SCOTTISH GEOGRAPHICAL MAGAZINE.

SOME OLD MEXICAN VOLCANOES.

By HENRY M. CADELL, B.Sc., F.R.S.E.

(With Maps and Illustrations.)

THE United States of Mexico have not yet become a happy hunting-ground for British travellers, and the man in the street, unless perhaps specially interested in silver mines, knows little and has few opportunities of learning much at first hand about that very interesting country. Mexico is a land of good natural resources and great possibilities, and it is high time that our acquaintance with the natural characteristics of the Republic should be improved, and our geographical knowledge extended of its mountains, plains, and important physical features.

With a view to the better education of other countries in this direction, the Government of the Republic invited the tenth International Geological Congress to meet in Mexico City last autumn, and the invitation to attend that cosmopolitan assembly was the occasion of my visit to Mexico. The guests were treated with the greatest kindness and hospitality by the venerable President and the numerous governors and state officials at different parts of the Republic. Unique facilities were afforded of visiting places of scientific interest remote and difficult of access to the ordinary private traveller unacquainted with the language and manners and customs of the people. Expeditions were organised, and excellent horses—without which travel in Mexico is impossible—were provided along with armed escorts, ensuring not only perfect safety but reasonable comfort and freedom from the anxiety that solitary travellers are liable to experience in districts more or less remote from civilisation and a perfectly settled government. The escorts, armed as they were to the teeth with rifle, sword, and revolver, may indeed have

been sometimes necessary, but were no doubt sent partly as a compliment to the scientific strangers, like the numerous banquets and entertainments to which they were treated wherever they went. For all these amenities of travel it is now a pleasure no less than a duty to make public and thankful acknowledgment.

The United States of Mexico, after nearly a century of more or less stormy independence, have now, unlike many of the neighbouring Spanish American republics, begun to settle down to a measure of political rest. The rising generation is learning that it is not only quite possible to thrive without the excitement of periodical revolutions, but that a strong and settled government is a positive advantage and worthy of general support. This happy discovery arises from the prolonged and beneficent reign of the strong man who sits on the throne of Mexico, for the Mexico of to-day is to all practical intents and purposes not a constitutional republic as we understand the term, but an absolute monarchy, and General Porfirio Diaz, although nominally its President, is in reality an autocrat of a pronounced type. But he is a benevolent as well as a capable autocrat, and his rule is well adapted to and liked by the great majority of his subjects. After thirty years of arduous work he has succeeded by military skill, political wisdom, and strength of purpose in overcoming the most powerful obstacles and in bringing order out of the chaos and misgovernment of centuries of Spanish misrule and republican strife. He has lived to reap the reward of a long and strenuous life in seeing the financial credit of Mexico built up from less than *nil*, and the country raised like Egypt to a condition of prosperity and security it has never enjoyed before.

General Diaz celebrated his seventy-sixth birthday on the 15th of September last, the day before the great anniversary festival of Mexican Independence. The writer had the honour to be his guest in the National Palace in Mexico City that evening, and it was a pleasing spectacle to see the ovation which the venerable soldier and statesman received when he appeared on the balcony of the Hall of the Ambassadors, waved the national flag, and greeted the assembled multitude in the square below—an ovation that proved to a stranger how large a place he holds in the hearts of his countrymen, who, to the number of fifty or sixty thousand, were waiting to do him honour.

With the establishment of a strong central government, not only determined but also able to put down violence, mischief to property, and highway robbery, and thus to make travel fairly safe in a country that was, until comparatively recently, infested with thieves and bands of dangerous outlaws, the facilities for travelling have become greatly improved. The Mexican law, which is severe against certain classes of evil-doers, is relentlessly carried out. Any one, for example, who is found placing obstacles on a railway that may cause an accident, or interfering with the public telegraph wires, may be executed by the police without a trial. Only the week before I landed in Mexico last August, three men were apprehended for unscrewing the fish-plates on the Mexican Mountain Railway near Esperanza, with the intention of upsetting the train at a dangerous part of the line. Happily the engine

and the first cars crossed the weak spot in safety, and the rear part of the train, although upset, turned over towards the mountain and so was not thrown over the precipice on the other side of the line. But a terrible accident might easily have been produced, and the mischief-makers, who had been hunted down and admitted the crime, were dragged to the spot and shot by the police without further legal formalities. By such summary means the majesty of the law has been maintained and a vast number of evil-doers have been eliminated, greatly to the advantage of the travelling public, so that now it is undoubtedly safer to travel in Mexico than on many railways in the enlightened Republic to the north, where the arm of the law is so weak that robbers can often evade or defy it with practical impunity. Mexico is, however, a vast country with an area of 767,000 square miles—as large as the United Kingdom, France, Germany, and Austria-Hungary combined—and parts of it are inhabited by wild tribes of predatory Indians who have never been conquered and among whom it is almost impossible to travel in any capacity. These remote regions, situated chiefly on the Pacific slope, have consequently been hardly ever explored, and very little humanity is shown to their troublesome inhabitants by the central government.

In certain districts Mexico possesses enormous stores of mineral wealth, and it was mainly the glitter of its silver and gold that led to the original Spanish invasion of 1519 and the subsequent conquest of the country by Cortes and his band of dauntless adventurers. The hunt for precious metals is still the great incentive to exploration as well as the leading industry in the more remote and mountainous tracts. The mines are mostly worked by foreigners, and it is no secret that the large interest the Americans are acquiring in this direction is causing considerable uneasiness among the native Mexicans and the ruling classes, who are beginning to desecrate the Utitlander looming up rather ominously for their future peace. The American mining explorer from the Western States, although in many ways quite a useful pioneer, is in many other ways an obnoxious neighbour to the old-world and well-mannered Mexican, who resents rough treatment, particularly from his own guests who are enjoying the benefits of his hospitality and making fortunes from his native soil.

The Mexicans prefer to let outsiders not only open up their mines but make most of their railways, and now that a solid government is established, the natural resources of the Republic are being steadily developed by foreign capital. There is here an excellent field for profitable commercial enterprise, especially by the British, who cannot be suspected of any ulterior political designs on Mexico, and are therefore likely to be more acceptable concessionaires than the 'cute Yankee from the adjacent Republic. The friendship between our respective governments was demonstrated last September in a pleasing way when the King, through his able minister, Mr. Reginald Tower, invested President Diaz with the order of G.C.B. The function was performed in the presence of the British colony in Mexico, over three hundred in number, and it was pleasing to observe the appreciation of the venerable President

on receiving a signal mark of honour from a British sovereign which has seldom, if ever, been conferred on the head of any American State before.

While speaking of the progress of Mexico, it is only right to mention that although, mainly through the influence of her present powerful ruler, she has succeeded in establishing for the time being a strong and able government adapted to the present state and material requirements of the country, the social and moral condition of the people generally still leaves very much to be desired. The population of the Republic is over thirteen and a half millions, and that of the capital about four hundred thousand. Although education is progressing steadily, and wealth is accumulating fast, the magnificent streets and buildings of the capital do not yet include a university, while the vast mass of the rural population remains quite illiterate. The Peons or agricultural labourers on the huge haciendas (or estates) are practically in a state of serfdom, with no chance of bettering their hard lot or getting rid of the debt in which they are often kept purposely involved all their lives by their wealthy employers. Many of these estates are of enormous size, and several exceed a million acres in area. It is no uncommon sight to see twenty-five pairs of horses ploughing one field in the rich Valley of Mexico, where the farms are well cultivated and extremely profitable.

A large part of the valley is devoted to the cultivation of the Agave or great aloe, the extraction of whose juice, when the plant reaches maturity, is a most lucrative branch of agriculture. The pulque or liquor made from the fermented juice is the favourite national drink, and the pulque haciendas, on which, over many square miles, the prickly aloes are planted in lines of remarkable mathematical precision, produce a characteristic and very striking feature in the landscape. The craving for pulque, like that for intoxicants with us, is a source of much poverty and crime among the common people, and the authorities, headed by Senor Guillermo de Landa y Escandon, the distinguished Governor of the Federal District of Mexico, are endeavouring, and with marked success, to diminish this evil by restricting the sale of alcoholic beverages on working days and suppressing it entirely on half-holidays.

Another conspicuous feature of the country is the enormous number and magnificence of the churches. When the Spaniards first came to Mexico in 1519 they found the Aztecs, who were then the ruling race, addicted to horrible human sacrifices and cannibalism, and they resolved, while bringing these pagans under the Spanish rule, to erect the Cross in every town, and give them the benefit of a better religion as well as a better government. Their aims were thus not altogether sordid, but after nearly four hundred years of Papal domination better results should be apparent now. In spite of the magnificence and number of the ecclesiastical edifices, the priesthood at the present day seem incapable of using for the greatest good the vast influence and organisation at their disposal. The church a generation ago had so aggrandised itself that it came to own the best of the land, as it did in Scotland before the Reformation, and ruled the country for its own ends and so badly that the people finally rose against its tyranny, and disestablished it for ever. The enormous property it had unrighteously accumulated

was appropriated by the State and sold for public purposes, and the monasteries and convents, which had become hotbeds of mischief and idleness, were abolished and turned into schools and other useful institutions. So drastic was the measure that now the priests are not even permitted to wear their ecclesiastical vestments in the streets, and all religious processions are strictly prohibited outside the churches. The horrible Inquisition was abolished long ago, and persecution is now quite at an end, perfect freedom of worship being at the same time accorded to all religious denominations in the Republic.

Among other much-needed reforms carried out by President Diaz was the institution of the Rurales or Mounted Police force, a fine efficient body of men whose acquaintance we had many opportunities of making while travelling in the country districts. The Rurales were originally bandits, with which Mexico used to swarm, and the story is told of how Diaz summoned a large body of them to meet him, and then asked them frankly how much the average remuneration from their predatory profession might amount to. On hearing the sum he promised, if they would give up plunder and enlist in his service, he would double their pay and turn their misdirected energies into a useful channel. This advantageous offer was accepted with alacrity by the great majority, who knew the ways and haunts of robbers intimately, and were thereupon employed to hunt down the recalcitrant minority and clear the land of undesirables generally. The Rurales are now the best force at the disposal of the Government, and the principal instrument for upholding the majesty of the law throughout the length and breadth of the land. It is thus evident that, from a geographical point of view, the Rurales deserve special notice, their services to travellers being of the highest importance.

The physical geography of Mexico, full of interest as it is, has not yet been much studied. Mexico City, the capital, situated in the Federal District, extends over a flat plain surrounded by chains of old volcanic hills and mountains. The valley is an enclosed basin with no natural outlet, and is partly occupied by shallow lakes fed by streams from the neighbouring heights. Although the basin is enclosed, the water is fresh, and this is one of the interesting physical peculiarities to be observed in different parts of the country. The plain is part of the great Mexican plateau between 7000 and 8000 feet above the sea, and is reached by two mountain railways—the Mexican and Interoceanic—from the harbour of Vera Cruz on the Gulf of Mexico, which run with many windings from the hot coastal plain, where sugar-cane and bananas flourish, up to the cooler region of maize and barley. The mean annual temperature of Mexico City is about 61° F., with a maximum of 89°, and a minimum of 35°, and the rainy season is in summer between May and September, when in the afternoons the clouds gather and heavy thunder-showers are of almost daily occurrence.

The plateau at this season is covered with bright verdure, and the fields are variegated with good crops and decked with flowers of lovely hues. After the rains cease the grass withers and the land becomes brown and dusty until the dry winter months have passed away.

Texcoco, which is the largest of the lakes on the plateau, is about 12 miles long and 8 miles wide. It was much larger in the time of Cortes and the Aztecs. Mexico City, or rather the site of the present city, was then an island approached by embanked causeways from the adjacent shores, but the waters of the lake, which is quite shallow, have retreated in consequence of vast drainage operations begun by the Spaniards and extended by modern engineers. The city is now (superficially) on dry land, and the shore of the lake is six miles away, but the subsoil remains full of water, so that it is impossible to construct dry cellars under the ground level. The soft alluvial soil makes bad foundations, and many handsome buildings have been badly twisted by the yielding of the ground as the water-level has been gradually lowered. There is in the city a good deal of malaria and typhus fever, and pneumonia is a common trouble among the thinly clad and overcrowded natives of the poorer class, the result being that the death-rate sometimes reaches 60 per 1000 in spite of the modern sanitary measures that Government has inaugurated.

The highest mountains in Mexico are all volcanic, with, as a rule, the characteristic conical configuration. The first mountain the traveller sees as he approaches the coast is the mighty snow-capped peak of Orizaba, to which I shall refer later, and the most striking objects in the landscape at Mexico City are the white crests of Popocatepetl and Ixtaccihuatl, which rise into the sky far above the multitudes of smaller volcanic cones around them. The principal active volcano is Colima, near the Pacific coast and over 12,000 feet in height. An excursion was organised to Colima, but I preferred to join the expedition which went at the same time to Jorullo, a recent volcano no longer in activity, whose remarkable history has been noticed in all good books of geology and geography since the great Baron von Humboldt made his memorable visit to it in 1803.

The subject of the following pages will be the four old volcanoes, Nevado de Toluca, Jorullo, Orizaba, and Popocatepetl, and the order of their description will be that in which I visited them in August and September 1906 and not the order to which their relative geographical importance may entitle them.

NEVADO DE TOLUCA.

This mountain was visited on the way to the volcano of Jorullo, and the party which set out from Mexico City to see it on the 28th of August was a fairly cosmopolitan one. It included representatives of Germany (who were most numerous), France, Italy, Austria, Russia, Finland, the United States of America, and Great Britain, besides several Mexican geologists, the number being about thirty all told. The United Kingdom was represented by only two geologists, Mr. Bernard Hobson from Manchester University, and the writer from Scotland.

The Mexican National Railway resembles all the others in the Republic in being a single line. Like the less important railways it is on the metre gauge adapted to light trains in a country of great distances,

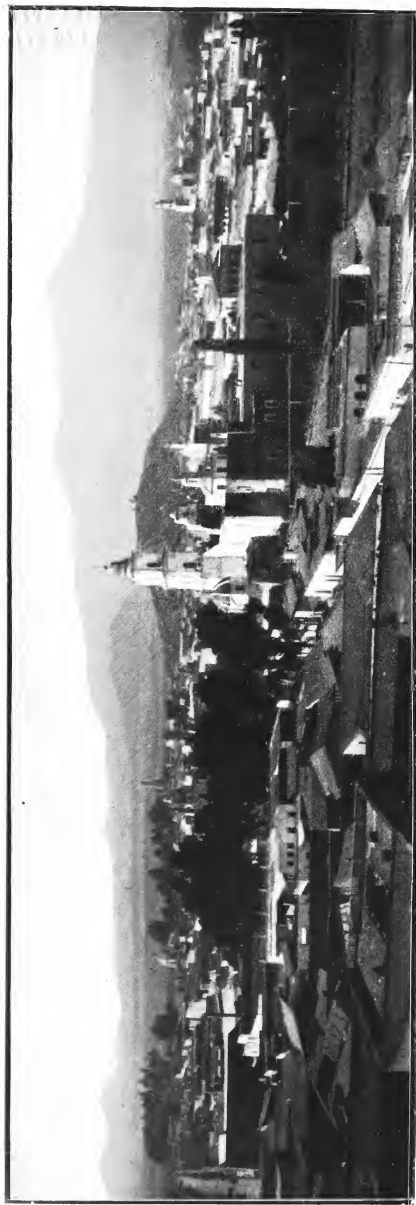


FIG. 2.—Nevado de Toluca from City of Toluca. (Photo by B. Hobson.)



FIG. 3.—Panorama of Lake of Patzcuaro from Las Balcones. (Sketch by Author.)

where the traffic is as yet comparatively small and industry only partially developed. The line rises from the valley of Mexico, which is 7440 feet above the sea, to the cooler plateau of the valley of Toluca 46 miles west of the capital, and about 1200 feet higher up. At the city of Toluca, a clean old town with a population of some 25,000, a sumptuous banquet was provided for the hungry geologists by Señor Gonzales, the hospitable Governor of the State of Mexico, and next morning the expedition to the old volcano started in earnest.

Xinantecatl or Nevado de Toluca, the fourth highest mountain of Mexico, rising as it does to a height of almost 15,000 feet, is a conspicuous landmark in that part of the country, but scarcely reaches the snowline and is only white in the winter months. The average height of the valley of Toluca is, according to Mr. T. Flores, 2630 metres or 8628 feet, so that the mountain has not quite the imposing appearance of other old volcanoes whose base is at a lower level. The accompanying figure (2), from a photo by Mr. Hobson,¹ shows the view from a small hill close to the city, with the old parish church built in 1585 in the centre of the picture and several characteristic little cones protruding above the plain in the middle distance.

The first part of the journey was by rail to Calimaya, a village eleven miles from Toluca. On alighting from the train we found drawn up in line a gallant company of the Rurales awaiting us. There were some thirty-five troopers, each with a spare horse, and having selected the largest and strongest I could find, I rode off with the cavalcade, numbering some seventy horsemen and horsewomen (a few ladies having joined the party), besides a detachment of baggage mules and Indian mozos. We galloped off to the strains of martial music from the band and drummers of the town, and as we passed along the narrow little streets the whole population turned out and let off rockets and fireworks in profusion, which, however, we could only hear and smell in the bright blaze of the tropical sun that lovely morning.

The road, or rather bridle-track, lay through fields of maize, barley, and aloe, on a soil of cream-coloured pumiceous ash, cut up by barrancas or gullies with vertical sides, which, fortunately for us, were quite dry although the rainy season was not yet over. As we approached the mountain these little cañons increased in depth, and the sides, sometimes over 20 feet high, showed fine sections of the white granular ash that reminded me forcibly of the gullies in the ash round Mount Tarawera in New Zealand, which I visited in 1895 and afterwards described in this *Magazine*. There is no frost to speak of in either country to cause the sides to crumble down, and the erosion of the barrancas is entirely caused by the torrents that periodically undermine their walls and keep them always vertical or even dangerously overhanging. Large slices could often be seen falling in, so that care was necessary not to ride too near the edge either above or below the cliffs

¹ This and all the other illustrations of this article are from original photographs taken by the author or his companions, or from panoramic sketches made by the author of scenes which were incapable of adequate photographic representation.

in such places. The base of the mountain is densely clothed with a forest, which rises to a height of about 13,500 feet, and it was impossible not to be struck with the lovely flora of the cool mountain slopes in this temperate island under a tropical sky.

Three kinds of broad-leaved deciduous trees were conspicuous, the oak, alder, and a dwarf willow. The oak is a more vigorous-looking tree than any of the ordinary British species. It has large glossy leaves white and downy on the under surface. The alder closely resembled our common European species *Alnus glutinosa*. The main mass of the forest was, however, of *Pinus Montezumæ*, a tree like the Corsican (*laricio*) in habit but with three long strong needles in each sheath instead of the two which are the common characteristic of the Austrian, Corsican, and Scots pines of Europe. Many of the trees were $2\frac{1}{2}$ to 3 feet in diameter, and the saplings showed rapid annual growths of 3 to 4 feet. Most of the larger stems had been gashed for resin, and woodcutters were at work making square axe-hewn logs where the forest was being cleared. There was no attempt at anything like systematic forestry, either in clearing the old or in propagating young trees to replace them, and this is a subject that might well be considered in connection with the other Government schemes for developing the natural resources of the country.

The ground under the trees was carpeted with lovely flowers of many hues, conspicuous among which were bunches of lavender-coloured lupine, and spikes of the common crimson penstemon, such as grows in all old-fashioned herbaceous borders in Scotland. Among many other flowers I did not know it was not difficult to recognise such old friends as the daisy, horsegowan, yarrow, comfrey, vetch, stitchwort, wild geranium, red salvia, which, if not identical with, were all nearly related to the common European varieties. Thistles of various sorts were there also, and among different ferns the common bracken (*Pteris aquilina*) was plentiful, if not on this mountain, at least on others I shall again refer to. Like the black crow the bracken seems to thrive everywhere. I have seen it in the wilds of Western Australia, and other travellers have noticed it in remote parts of Africa. There was, however, no heather, or anything like it, with its bonnie purple bells, on any of these Mexican mountains.

After a ride of ten or twelve miles through this delightful flowery forest we reached the camping ground at 11,000 feet above the sea, where the air was perceptibly cooler and a blazing fire was a welcome sight. Our kind hosts and our energetic young guide, Señor Flores of the Mexican Geological Institute, had built large wooden huts to shelter us during the night from the cold and the tropical rain that might fall in torrents at any time after sunset.

Next morning, after a cold and somewhat sleepless night, the bugle sounded the rouse at five, and after a snack we mounted our nimble steeds and made for the crater. As the sun rose above the eastern horizon the view from the camp was truly magnificent. Gazing through the tall ruddy stems of the pines into the blaze of golden light beyond, the eye swept over a vast and variegated plain flecked with woods and

lakes and little clouds, and bounded by ridges of purple hills, beyond which, in the far distance, seventy to eighty miles away, the majestic cone of Popocatepetl and its rugged companion Ixtaccihuatl lifted their snowclad summits high into the clear morning air. By nine o'clock the lovely vision was ended, the mantling clouds rose and swathed the distant mountains in their fleecy folds, keeping them entirely hidden all the rest of the day.

Towards 13,000 feet the pines, which at that altitude had entirely



FIG. 4.—Lower Crater Lake, Nevado de Toluca.

superseded the broad-leaved trees, became smaller, and ended somewhat abruptly about 500 feet higher up, leaving nothing but dull green grass and a few flowers growing thinly on the smooth mountain side above. A good bridle-path winding round a shoulder with a smooth sharp crest of crumbling grey ash, led to the crater lakes beyond, which were the objective of the expedition.

Nevado de Toluca is a volcano of Tertiary age which has not been active within historic or traditionary times, and no steam or vapour now issues from any part of it. There are two crater lakes on the summit, the larger of which—the Laguna Grande—is 300 metres long

by 213 in breadth, with a maximum depth of 10 metres or 33 feet. The height of this lake above the sea is 4270 metres or a little over 14 000 feet, and the highest point of the crater rim above it is 4565 metres (=14,977 ft.), or practically 15,000 feet, according to the latest measurements by Sr. Flores. Nevado de Toluca holds the fourth place among the great Mexican volcanic peaks, and comes next after Ixtaccihuatl, Popocatepetl, and Orizaba, the giant of the group. It is, however, proper to note that none of these mountains have yet been mathematically surveyed, and the heights are only more or less close approximations obtained by the thermo-barometer. Different observers have obtained different results with considerable variations between them, and until mathematical rather than meteorological methods of



FIG. 5.—Upper Crater Lake, Nevado de Toluca.

height measurement are adopted, the absolute altitudes will not be accurately determined.

The crater, which is elliptical in plan, is 1565 yards long by 650 wide. The rim is gashed with irregular lips and partly buried under long scree of reddish crumbling ash and lava, through which rugged knotty spurs and knobs project at intervals. The lavas are of the hornblende-hypersthene andesitic class, and these covered by pumiceous tuff and breccias form the body of the cone. The main crater has in the centre a small lava dome rising prominently between the two little lakes, and this seems to have been the result of the expiring efforts of the volcano.

As the party ascended towards the rim the thin air began to tell on the horses, and they, like some of their riders, showed signs of considerable fatigue. From humane feelings some of us were glad to

dismount and lead the tired animals over the last ridge. The noses of some of the riders began to bleed, and none of us felt equal to great exertion, so that the sight of the camping-ground on the shore of the Laguna Grande was extremely welcome both to man and beast. The very height of Mexican hospitality was here reached in the shape of a boat that was being laboriously carried up on the shoulders of a squad of stout Indians for our delectation on the waters of the placid lake, 14,000 feet above the sea.

Numerous photographs were taken of this interesting spot, two of which are now reproduced in Figs. 4 and 5. The ride back to Calimaya Station, by a more direct route than that of the previous day's ascent, did not occupy more than six hours, and we returned to Toluca after darkness had set in.

THE VOLCANO OF JORULLO.

From Toluca the route lay westward through a country of cultivated shallow valleys and volcanic cones, covered for the most part with small trees. A day was spent in Morelia, the capital of the State of Michoacan, 188 miles distant by rail from Toluca. A beautiful old city of over 30,000 inhabitants, founded in 1541, Morelia is situated in a characteristic strath with fields and lakes encircled by high wooded volcanic hills. The city, like the capital and many others in Mexico, was anciently supplied with water by a long aqueduct from the hills, the old Gothic arches of which form one of the many picturesque features of the quaint Spanish architecture of a former age. Perhaps the most wonderful object of a geological kind that came under our notice at the Michoacan Museum was a lump of vesicular lava about a foot in diameter, from an extinct volcano, which was full of charred heads of maize of a very distinct character. This specimen, collected at the Hacienda de la Magdalena, $11\frac{3}{4}$ miles from Morelia, and near the volcanic Pico de Quinceo, was doubly interesting, as it confirmed the observation that has been occasionally made in other countries, that lava can sometimes preserve fossils, a fact that very few geologists would be prepared to admit on theoretical grounds only; and it also proved that maize has been cultivated by the Indians for many centuries, at a time when several of the volcanoes, now apparently quite extinct, were still in a state of activity (Fig. 6).¹

Under the able guidance of M. Ezequiel Ordóñez, sub-director of the Geological Institute, who here joined the party, we were conveyed by rail to Patzcuaro, 39 miles west of Morelia, where the hard work of the expedition was to begin. Patzcuaro is a clean little town with the usual square or plaza containing a well with shady trees and numerous churches and shrines. Like other villages in that remote place, it shows a mixture of ancient Spanish and modern scientific conveniences, includ-

¹ A short account of this remarkable specimen, and notes of other records of plant remains in basalt, are to be found in the *Geological Magazine* for May 1907. The accompanying figure is reproduced here by the kind permission of the editor of the Magazine.

ing electric light derived from the waterfalls in the neighbouring mountains. The town is situated about 250 feet above the railway that skirts the great lake of Patzcuaro, and a mule tramway conveys passengers up from the station, a distance of a mile and a half. On the return journey

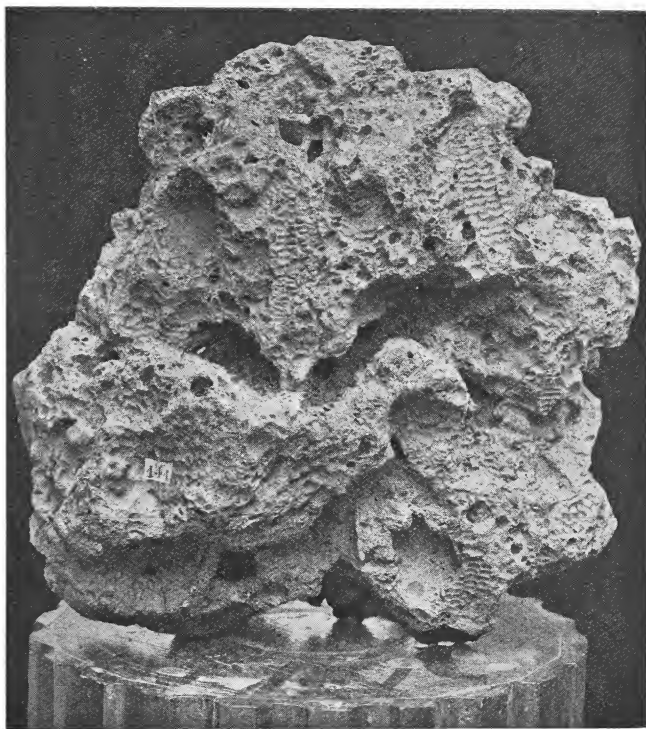


FIG. 6.—Basaltic Scoria containing heads of Maize, preserved in the Michoacan Museum, Mexico.

the car is allowed to run down by gravitation, the mules following it at their leisure.

The Lake of Patzcuaro is seen to best advantage from Los Balcones, a view-point about 100 feet above the town on the volcanic hill of El Calvario. I visited this lovely spot on two different occasions, and had time to make a panoramic sketch of the magnificent scene which is reproduced on a small scale on Fig. 3. The lake, although it has no outlet, is quite fresh and full of fish. The inhabitants of the numerous villages on the islands and round the shores live by fishing and agricul-



FIG. 7.—Midday halt at Rancho Nuevo. (Photo by Dr. W. Wahl.)



FIG. 8.—Distant view of Volcano of Jorullo.

ture, and their fleets of square-ended dug-out canoes skimming about the lake add life and interest to the picture. The lake is $12\frac{1}{2}$ miles long and not much more than 23 feet deep. It is studded with islands—the tops of small volcanoes like those that peep up through some parts of the plain of Mexico—and is surrounded by groups of great volcanic cones densely wooded to the crest but fringed below with a patchwork of cultivated fields sloping gently down to the water's edge. The surface of the water is 6697 feet above the sea, and some of the surrounding mountains rise to heights of a few thousand feet above the lake. When they were in activity they were no doubt considerably higher, as the craters are generally more or less worn away. The whole scene must at that time have been one of terrific grandeur as each eruption filled the air with clouds of steam and ashes, and the craters vomited forth fiery floods of lava to choke up the river valleys and produce great lakes with the impounded water.

The night was spent in the small hotel, and next morning we were up at 4.30, and an hour later we were all mounted and off on our 60 miles' ride to Jorullo under the protection of a company of trusty Rurales to see that we neither did nor suffered harm on that mysterious journey. Some natives whom we passed asked if we were not afraid to go near that dread mountain, the tradition of whose terrible eruption nearly a century and a half ago still haunted the popular imagination.

The first day's ride was over a hilly district, partly wooded and partly cultivated with maize, which thrives well on the rich volcanic soil. The country was not unlike some parts of the Scottish Lowlands, with grass parks among rounded hills, and fields in which oxen were working with the primitive wooden plough of the country. The roads are not much better than bridle tracks running across country and through the streams or river beds that traverse them, only the deepest of which are spanned by wooden bridges. Happily for us, although there were local floods at other places, the weather in that district had been unusually dry, so that the streams were all passable, and the mud, which was deep enough at places, was sufficiently hard to let the horses through without much difficulty.

After a ride of 12 leagues or 30 miles we reached the small town of Ario, where the first night was spent in the prefecture or quarters of the chief magistrate, a roomy old place with a small patio or central court, off which several good-sized apartments opened, in which beds had been placed for our night's lodging. Like Patzcuaro, the village was lit with electricity and could boast of an instrumental band, which assembled in the patio and discoursed good music all the evening, to the delight of the visitors, who were objects of great interest to the whole native population. A local poet came in after supper when the usual toasts were being honoured, and recited appropriate verses, which, however, being in Spanish, were only understood in a dim, general way by most of us. The sentiment, however, was duly appreciated and applauded by all.

Ario, which lies directly south of Patzcuaro, is nearly 1000 feet lower down and on the edge of the Mexican Plateau. Its altitude is 6200

feet, and the road is on the whole a long descent of about 3900 feet from Ario to the base of the lava field of Jorullo. The following morning by six we were all saddled in and ready for the long descent into the Tierra Caliente or hot country. The path was very rough, and the red volcanic clay bottom so slippery, that even the best riders and some of the Rurales had bad spills at places.

The road followed a long, shallow valley, filled up ages ago with lava streams, which had rotted down into a soft, brown clay. Deep barrancas had been excavated by the torrents in wet weather, some of which were dangerously near the edge of the slippery way. The hillsides and upper part of the valley were covered with bushes and pines.

After a halt for breakfast at the Rancho Nuevo, a hacienda or large farm building 11 miles from Ario and 1600 feet lower down, the journey was resumed at noon (Fig. 7). The path entered a lovely pine forest with open glades, through which it was possible to gallop along quite comfortably. At about 4500 feet above sea-level the pines ended and the tropical forest was entered. The path ran through a jungle of fan palms and mimosas, and past groves of bananas and sugar-cane. The palms were often entirely encircled in the ivy-like embrace of a climbing fig, and covered with tufts of orchids, with which I stuffed my saddle-bags to cultivate under glass at home. Huge yellow bunches of a large-leaved kind of mistletoe hanging from the spreading branches of the trees reminded one of far other scenes and cooler climes, while here and there rude straw-thatched dwellings of Indians were to be seen, the inmates of which showed no disposition to molest us, and were indeed to all appearance most friendly in returning our passing salutations.

As we entered this delightful country the goal of our journey hove in sight. On the opposite side of the valley below us a black, flat-topped hill, partly covered with bush, appeared standing alone against a background of higher mountains covered with grass and forest (Fig. 8). This was the famous Volcano of Jorullo, which Humboldt's description has made classical in the geological world. It was entirely unlike the pictures or descriptions I had seen, which are mostly copies of Humboldt's original sketch. A reproduction of this taken from his atlas is now given for the sake of comparison with the picture that presented itself to us a century afterwards (Fig. 9). Humboldt's description and those of several later travellers are inaccurate in several respects, and it is well that the results of the latest and most exact investigations should now be recorded for the benefit of geographers and geologists in Europe, as it is not likely that many at home will soon have such an opportunity, even if they had the will, to risk the journey to such an outlandish spot to make the investigation for themselves.

Continuing our ride southwards, the lowest point was reached at the Hacienda La Playa, a hamlet at the north side of the Jorullo amphitheatre where we were regaled with glasses of warm milk, and the Germans of the party found beer provided for them free by the hospitable Government, for all of which kindness the tired and thirsty travellers were most grateful. The bottom of the valley is here about 2300 feet above sea-level, and nearly 5000 feet below Patzcuaro. The bed of the

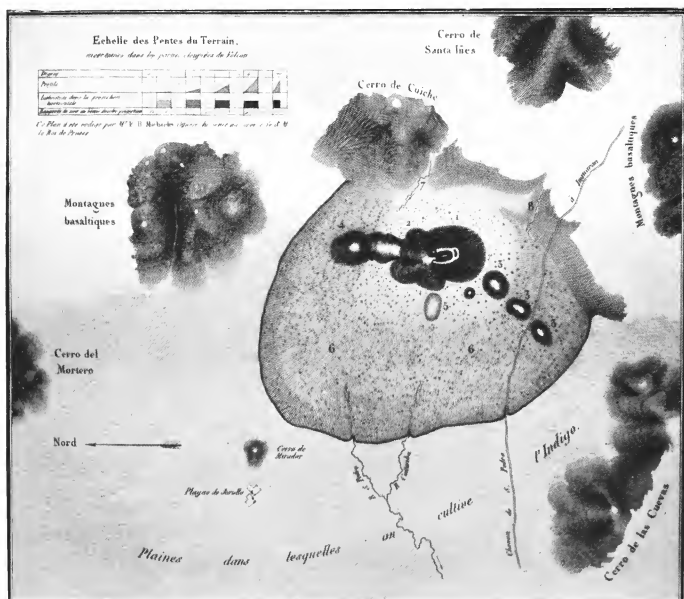
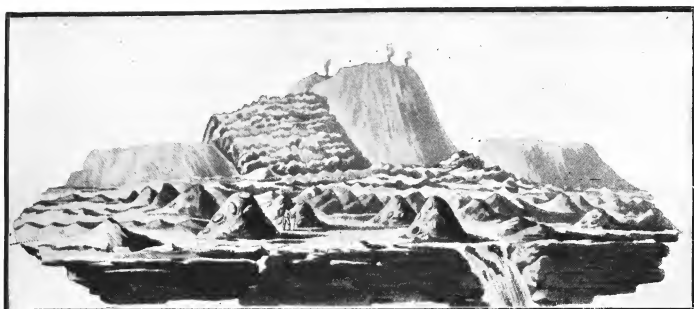


FIG. 9.—Sketch, Map and Section of Jorullo, as drawn by Von Humboldt after his visit in 1803.

valley is occupied by the San Pedro river, a muddy stream which was forded on the way to the camping place a few miles farther on.

After leaving La Playa, the soil, hitherto brown, became black and sandy from the ashes of Jorullo that began to cover the ground and increased in quantity as we approached the volcano. On the left or east side of the river the path turned eastwards and upwards over the edge of the oldest of the lava streams of Jorullo. The Malpays or "bad land," as this rough lava-covered ground is called, had a thin covering of sandy ash, on which rough grass, flowers, and scattered mimosa trees were growing, while the shady nooks in the rough basalt knobs were shaggy with maidenhair and other tropical ferns.

This part of the road was most attractive to traverse, but after a ride of some thirty miles a climb of 1000 feet during the last four miles of the way under a tropical sun, with the thermometer at 90° F., was rather trying both to man and beast, and our horses were scarcely able to follow us as we toiled on foot over the old lava streams up to our night's quarters on the mountain side.

I have already referred to the mineral wealth of Mexico, which is most abundant among the mountainous districts composed of old volcanic rocks, and to the inducement it offers to exploration in remote places. It so happens that copper exists in this district, and mines have been opened in the old volcanic plateau to the south-east of the volcano by the *Compañía de Inguaran*. The comfortable house of the manager at Mata de Platano, about a mile south of the cone of Jorullo, had been kindly placed at our disposal, in the spacious verandah and rooms of which, after supper and a delicious bath, we were snugly housed for the night. A panoramic sketch giving an outline of the magnificent view obtained from this point is given in Fig. 10, and a photo of the cone of Jorullo, and our night's quarters, in Fig. 15.

The following day the horses were too tired to go out, and we rose at five and proceeded to explore the volcano on foot. Under the guidance of Señor Ezequiel Ordóñez, who had surveyed Jorullo, and acted as a most admirable conductor to the party, and accompanied by a retinue of Indian *mozos* to attend to our bodily wants, we were able to study the mountain under the most favourable conditions.

The volcano of Jorullo lies at the east side of an amphitheatre of ancient volcanic hills much worn away, on the slope of which, about a mile south of the cone and 700 feet below the summit, the houses at Mata de Platano are situated. We descended the grassy side of the old basaltic plateau, crossed a small stream, and then began to climb the slope of black ashes surrounding the principal crater. The way led upwards along a dry barranca cut by torrents in the finely stratified black sand and lapilli overgrown with beautiful ferns, mimosas, and umbrageous fig-trees, with spreading limbs and stems a yard or more in diameter. The upper part of the ash cone has a slope of 30° to 35°, and is mostly covered with bushes and jungle, the sides being furrowed with deep channels. As we neared the top a thunderstorm burst over our heads, and it was soon abundantly evident how these steep channels came to be washed out. But in half an hour the clouds rolled away,

and the sun burst through and continued to beat fiercely down on us all the rest of the day.

Jorullo is quite an insignificant volcano in comparison with hundreds of others in Mexico, and the highest point on the crater's brink is not more than 4330 feet above sea-level. The top of the cone is about 1700 feet above the lowest part of the old valley at La Playa, and 1312 feet above the actual base of the volcano on the west side. On the east



FIG. 11.—Tropical Vegetation on Cone of Jorullo.

side next the edge of the old valley the cone is only 574 feet high. Its interest is derived, not from its size but from its history, as its age is known to a day, and it was exactly one hundred and forty-six years and eleven months old on the 28th of August when we climbed its side, the first eruption having taken place on the 28th of September 1759.

As we emerged from the jungle on the outer slope the crater suddenly appeared before us—a huge pit more than 400 feet deep, with rugged sides of bare red rock and scoria. The centre was evidently subsiding as the sides were rent by deep fissures running concentrically round the cavity, each crack forming the edge of a rude bench and reminding



FIG. 10.—Panorama of Sierra Madre as seen from Mata de Platanos. (Sketch by Author.)

one of the seats round an ancient amphitheatre. The faces of the scarps looked quite fresh, and Mr. Ordóñez said large slices often slipped inwards as the contraction progressed. The sides converged to a point surrounded by loose talus slopes, and on the north side a deep gash was conspicuous in the rim, reaching half-way down to the bottom, through which the last of the lava streams had overflowed and poured down the side of the cone.

The bottom of the crater is, according to Mr. Ordóñez, 489 feet below the highest point on the rim named the "Pico de Riaño." The crater is elliptical in shape, being 568 yards in length from N. to S. and 421 yards in breadth. Steam and pale sulphur vapour could be seen rising from several of the fissures, the most conspicuous of the fumaroles being in the lip on the north side.

From the summit it was easy to see at a glance the relation of the volcano to its interesting surroundings. It has been described by Humboldt as rising from a plain, the surface of which swelled up at the first eruption like a bubble inflated from below whose roof reverberated with a hollow sound under a horse's hoofs. Now, it is not quite correct to describe the locality as a plain, as it is only a short valley between high mountains, in the form of a natural amphitheatre between eight and nine miles wide, and the extent of level ground cannot ever have been very great.

Before the catastrophe of 1759 the valley was so rich and lovely with its fields of sugar-cane, indigo, and guava, and its groves of bananas and palms, that it was known to the natives as "Jorullo," or the land of Paradise. But many beautiful spots in that part of the world are apt to be dangerous habitations. In the spring and summer of 1759 ominous rumblings of the earth were felt at Ario and over the whole district, while the now extinct cones Cutzarondiro were in full activity.¹ On the night of 28th and 29th September the natives, who had fled in terror to the neighbouring heights, beheld the valley over the space of more than a square league burst into fire before their eyes. Huge sheets of flames shot upwards from the earth, while incandescent stones were hurled to vast heights and descended in showers of fiery rain. A dense cloud of cinders and scorix hovered in the air brightly lit up by the fires in the throat of the new-born volcano. At the same time the terrified spectators saw, or thought they saw, the earth swelling up above the ancient level of the "plain," like the surface of a convulsed sea, while the waters of the San Pedro river were swallowed up in the fiery chasm where they were dissolved into their component elements. The surface of the earth round the volcano became embossed with multitudes of miniature volcanoes or "hornitos" which emitted incessant columns of smoke and steam.

This account of the eruption given by panic-stricken eye-witnesses is naturally not quite a reliable statement of what actually took place. Very little study is now necessary to prove that the oft-repeated story of the swelling up of the ground in one night is entirely a myth. Mr. Ordóñez,

¹ See *Scottish Geographical Magazine*, 1887, p. 146.

who has carefully surveyed the ground and sifted the historical evidence and traditions relating to the eruption, said to us that Jorullo remained in violent activity for five months, and was spasmodically in eruption for some seventeen years afterwards. Four distinct floods of olivine basalt lava were poured out, the boundaries of which are quite clear and have been accurately mapped by him. The welling up of the first of these from the original fissure or vent before the cinder cones were formed, may easily have misled the terrified natives into believing that the surface of the ground had bulged up like a gigantic bubble.

The first or oldest of the lava streams was the most extensive and covered an area of about $3\frac{1}{2}$ square miles. The rough barren surfaces, now clad with only a scanty covering of vegetation, are known as "Malpays" or "bad lands," and the "hornitos" or "little ovens" that figure so prominently on Humboldt's sketch are now scarcely recognisable. We examined several which, but for the earlier descriptions, would probably have never been noticed. They are insignificant mounds of black stratified ashes or lapilli, sometimes 5 or 6 feet high and 4 or 5 yards in width. They show signs of a central aperture or crack through which the vapour no doubt escaped, and they generally possess a solid or hollow cone of the underlying basalt lava round which the ashy layers have formed like the skins of an onion. Many of them are covered with mimosa trees and bushes whose roots find a congenial habitat in the laminated and porous soil. (Fig. 13.)

The hornitos mark the spots where the steam and gases bubbled up through the fine ash on the earlier lava streams while they were cooling. These excrescences do not appear on the fourth or latest lava stream which issued from the breach on the north side of the main crater, and hangs over the mountain side like a long brown tongue with an extremely rough scoriated surface free of ash and almost devoid of vegetation. The final effort of the volcano was to pour out this lava stream, which appears to have welled up quietly without the explosive violence which attended the earlier eruptions. As it overflowed the crust hardened, and the still liquid stream ran on through a tunnel the roof of which finally collapsed, leaving a rough gully in its track. This is locally known as the Street of ruins or "Calle de las ruinas." Under some of the Mexican lava streams caves have thus originated, the roofs of which are still intact. At the Pyramids of Teotihuacan in the Mexican valley one of these, known as the Grotto de Porfirio Diaz is so large that it provided a banqueting hall for a party of some three hundred members of the Geological Congress at their visit to that interesting place.

The accompanying map from the survey of Mr. Ordóñez shows the four lava streams, the main volcano and the volcancitos or smaller cones adjoining it. Humboldt and the earlier travellers stated that there were five of these minor vents, but this is not correct, as there are only three volcancitos, all of which are situated along one line about two miles in length. The direction is nearly NNE. and SSW., and this no doubt was the line of a fissure that opened when the first eruption took place. The Volcancito del Norte is situated about 1500 yards NNE. of the



FIG. 12.—Volcancito del Norte from ESE. (Photo by B. Hobson.)



FIG. 13.—Remains of a Hornito on lavafield of Jorullo. (Photo by Dr. W. Wahl.)



FIG. 14.—Jorullo from NW. showing “Malpays,” central cone, and volcancitos.
(Sketch by Author.)



Fig. 15.—Cone of Jorullo from Mata de Platano.

main crater, and the Volcancito del Sur just a mile to the SSW., while the Volcancito de Enmedio, the smallest of the group, lies between Jorullo and the Volcancito del Sur, which it closely adjoins. All these volcanitos are horse-shoe shaped, and the craters are breached on the west side. They rise to heights of from 180 to 394 feet above their respective bases, the highest or northern cone being 730 feet lower than the crest of Jorullo. The four cones all spring from the second lava stream, and apparently reached the explosive stage after it was poured out. All of them latterly became choked up and extinct except the central vent of Jorullo, which survived long enough to increase its cinder cone to its present dimensions and vomit out two more lava streams before its energies finally became exhausted. (Figs. 12 and 14.)

Two nights were spent on the mountain, and the accompanying



FIG. 16.—Native huts at Mata de Platano.

sketches and photos, taken by the writer and other members of the party, will convey a better idea of its features than pages of description. With the exception of a small deer and a couple of snakes, we saw no wild animals on the mountain. Fig. 16 shows the type of native huts in this district at Mata de Platano. The return journey occupied three days, and we arrived back in Mexico City on 1st September well pleased with the visit to Jorullo.

CITLALTEPETL, OR THE PEAK OF ORIZABA.

As the European visitor sails wearily over the steaming waters of the Gulf, the first sight of the Mexican coast as day begins to break is one not easily forgotten. The eye wanders over the deep blue waters towards

a line of low sandhills covered with scrubby vegetation most monotonous and unpicturesque in aspect. Far inland, away beyond a mysterious hazy background of high land smothered under banks of fleecy clouds, the form of a huge snow-capped mountain stands out in bold relief against the western sky. Citlaltepētł, the Mountain of the Star, as the natives call it, or the Peak of Orizaba, as it is generally known to Europeans, can be seen 100 miles away, and when free of clouds its pyramidal crest is the most impressive and conspicuous landmark on the Gulf of Mexico. Towering as it does in solitary grandeur far above the high plateau of Mexico to a height approaching 19,000 feet, Citlaltepētł is not only the highest mountain in the republic, but almost the highest in North America, being surpassed in height by only two others, Mount McKinley in Alaska, and Mount Logan in the Canadian St. Elias Range. (Fig. 17).

Before leaving the country I made up my mind if possible to survey it from the top of that lone peak, a spot on which very few Europeans and perhaps still fewer Mexicans have ever set foot, on account of the difficulty of access and atmosphere—or want of it—surrounding the snowy solitude. Not much information was available as to the best way to make the ascent, and it was necessary to find out the ways and means for oneself. Some members of the Geological Congress had been unsuccessful in the attempt, owing mainly to the tropical rains in August, but a few others who waited till September, when the weather was more propitious, reached the top. Among these were Professor A. P. Coleman of Toronto and some American geologists, and their valuable experience was placed at the disposal of the party with which I arranged to go at a later date. This was not an excursion under Government auspices like the ride to Jorullo, and as none of us were sufficiently familiar with Spanish, and native interpreters were not to be found, a difficulty arose at the outset. But this was removed when Mr. W. T. Tower of Chicago University, who had been studying the fauna of Mexico and knew the country well, kindly offered to act as our guide, interpreter, and friend.

The other members of the party were Professor F. D. Adams of McGill University, Montreal, Mr. R. A. Daly of the Canadian Geological Survey, Mr. G. O. Smith and Mr. F. E. Wright of the U.S. Geological Survey—six in all, including the writer. Permission had to be obtained from the Laird, for Citlaltepētł is situated on an estate of more than 1000 square miles, one of the many vast haciendas owned by a single proprietor. The district is, or was until recently, a favourite haunt of robbers and outlaws, and it is advisable, if not absolutely necessary, to have letters of introduction or permission to satisfy the estate officials of the respectability and inoffensiveness of unknown visitors. A letter of introduction was also given us by the obliging officials in Mexico to the Jefe Politico or Chief Magistrate of the district, asking him to provide police protection and an armed escort, if necessary, for three or four days on the mountain.

Such things as hobnails in boots and alpenstocks for mountaineering are not known to the Mexicans, but some of the pikes used by the picadors in the bull-ring with sharp iron shods were found in an old



FIG. 17.—Peak of Orizaba from Gulf of Mexico near Vera Cruz.
(Sketch by Author.)



FIG. 18.—Party preparing to descend from summit of Orizaba (18,206 feet).

curiosity shop, and they served our more humane purposes very well, while Professor Königsberger of Freiburg lent us an ice-axe for the ascents he intended to make. With these implements, ropes, goggles, and provisions, we set out from Mexico City by the train leaving for Vera Cruz at 7 A.M. on the 17th of September. The railway, a single line on the ordinary gauge, runs for the first 150 miles along the plateau, gradually ascending from the terminus in Mexico City, which is 7348 feet above sea-level, to the highest point at Esperanza, 8044 feet in altitude, where the steep descent down the edge of the plateau to Vera Cruz begins. We alighted at San Andres, the station before Esperanza, 7972 feet in altitude and 137 miles from the capital.

At San Andres a Rurale trooper was waiting, and he conducted us to the mule tramcar that runs across the valley to the village of Chalchicomula at the foot of the mountain. The valley seemed absolutely level, and the surface at that place was quite flat from the railway that runs south-eastwards along the base of the low hills on the one side to the foot of the mountain slope of Citlaltepētēl, three or four miles off on the opposite side. Now the curious physical circumstance was noticed as we returned three days afterwards, that the plain was not level in reality, but had a regular slope to the west or north-west. This was made abundantly clear when the tramcar to the station went off on its own account and ran all the way to San Andres, the mules following it at their leisure. There was no trace of a stream along the base of the hills that skirted the lower edge of the strath, which might have explained the gradual declivity. The valley, being of good alluvial soil, had been apparently levelled by water in a lake or washed flat by rain originally, and the only explanation that suggested itself was that the whole country had been tilted slightly up to the east at a recent geological period. Mr. Tower said he had noticed signs of this phenomenon in other valleys, and believed it indicated a general orogenic movement the extent and nature of which has not yet been investigated.

At Chalchicomula we found quarters in a small inn with a large name, "El Grand Hotel de Cielo Veinte" (the grand hotel of the twentieth century), where we engaged an Indian guide, Augustin, and seven *mozos* with horses, mules, and the necessary blankets to protect us against cold at night, and *sombreros* to shelter us from the sun on the snow by day. Next morning at 5.30 we were up, and after the customary formalities of loading the animals, the company, consisting of six horsemen, six pack-mules, one mounted guide, and one mounted Rurale, trotted off soon after daybreak.

The road led upwards through dry barrancas of yellow pumiceous ash with which the base of the mountain is covered on the west side, past the remains of ancient pyramids small in size but quite distinct in form, which, like the great pyramids of Teotihuacán, may some day be found worth exploration and restoration. The ground was well cultivated with barley and maize up to the base of the forest zone. At 800 feet above Chalchicomula the path ran into the forest, which here consisted of Montezuma pines with tall, straight stems two feet or more in thickness growing among lupins, penstemons, foxgloves, and other flowers

similar to those already noted on Nevado de Toluca. As we ascended, a good many firs of the spruce family made their appearance, and the three-leaved Montezuma pines became mixed with five-leaved pines of the Weymouth or *Strobus* family. (Fig. 19.)

At 12,000 feet the trees became thinner and the path began to wind about among stone-sprinkled mounds that at once recalled the moraines of old glaciated countries. All doubt on this point was set at rest when at one place a conspicuous boulder about six feet long appeared lying against the side of one of the mounds, and furrowed from end to end with magnificent glacial striæ, made all the more clear by the rain that had come on as the afternoon advanced. Unfortunately, owing to the bad light it was impossible to photograph this interesting relic of the ice age. From this point onwards the little glen up which we rode was entirely covered with moraines of a very distinct sort, produced when the ice-cap on the mountain extended six or seven thousand feet over its side, or twice as far down as it does in our time.

Citlaltepētāl was in activity from 1545 to 1565, and since then there seems to be no record of an eruption. That the glaciers had retreated before the volcano became quiescent was soon made evident. At about 13,000 feet the face of a lava stream apparently about a hundred feet high, and two or three miles long, was seen like a huge flat caterpillar creeping right down from the snowy side of the cone on to the top of these moraine mounds, and partly blocking up the valley between the main peak and the Sierra Negra, a minor but still lofty mountain shoulder on its south-western side (Fig. 20). That the lava was much younger than the moraines was clear from the circumstance that it had a rough and broken surface like that of any other recent lava stream, and had neither been worn away by any passing glacier nor greatly disintegrated by the weather, which at that altitude is as severe as in other cold regions. It was covered by pines at least a century old, and had all the appearance of being a product of one of the last eruptions.

The view westwards from the moraines at 13,000 feet was so extensive that we could see across the valley of Puebla and past the great dark cone of Malinche to the snowclad crests of Popocatepētāl and Ixtaccihuatl, a hundred miles away. Some idea of this splendid vista may be formed from Fig. 20, drawn from a sketch I made on the way up.

The Sierra Negra is the dark, bare cone of a separate volcano of great size which does not quite reach the snowline. It is covered with talus slopes of debris (Fig. 21), and is separated from the main peak of Orizaba by a flat saddle between two side glens. The path ran up the western glen, at whose water-parting the glaciers had taken their rise, and the lava stream had poured down half-way across the flat ground and solidified before reaching the opposite slope at the base of the Sierra Negra. In ascending to the night's quarters we passed round the front of the lava flow and turned northwards along its eastern edge.

At a height of about 13,500 feet some distance up the face of the lava cliff and close to the upper limit of trees, there is a small cave with a patch of level ground in front, and here we halted and kindled the camp fire. The thin air began to affect the horses, none of which

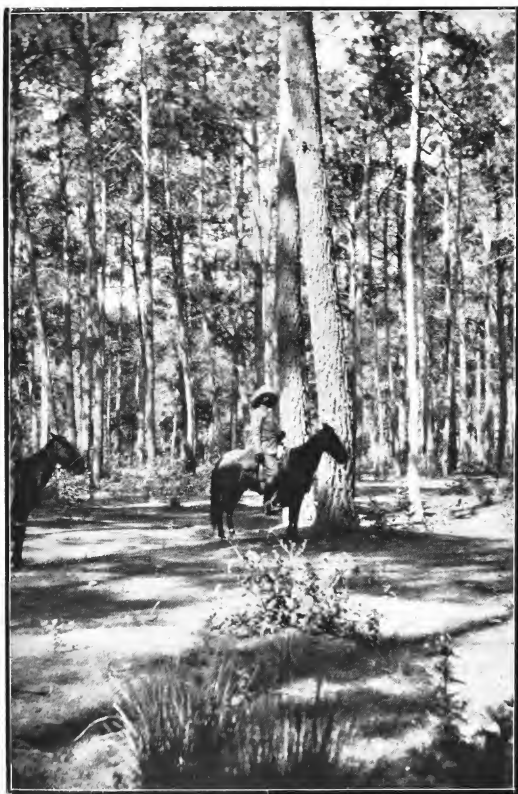


FIG. 19.—In the Pine Forest on Orizaba (10,000 feet).

were particularly good, long before we reached this height, and after a ride of fifteen miles and a climb of 5500 feet we were all glad of a night's rest even in such poor quarters under an old and cold lava stream. (Fig. 22.)

There are many famous caves in Mexico, by far the finest of which are in the great limestone deposits under the volcanic rocks. In some of these a whole cavalry regiment can camp comfortably. But the cave on Orizaba, like the grotto at Teotihuacan, is of volcanic origin and not produced by the dissolving away of the rock by water. It is a rough, irregular cavity perhaps seven yards long by three in width, but part of the bottom opposite the entrance is three or four feet above the lower story, and the roof comes down to within a couple of feet of the floor at one side. This fact one of the party who slept with his head under it had neglected to note, and when he rose suddenly in the dark next morning, he received a most striking reminder of it. Although the roof was leaky and the floor rough the cave was a useful shelter, and we soon had a blazing fire to make tea and dry our soaking clothes after the rain ceased to fall in the evening. For six or seven good-sized travellers the sleeping accommodation in such a hole was rather limited. The lair I selected, after the shorter men had been accommodated, had the disadvantage that three drops fell continuously on it—one over my feet, one on my nose, and the third into my ear—whichever way I turned; and to add to the comfort of the lodging, our good Indian friend Augustin, after we were all solidly tucked in downstairs in the first-class cabin, while the *Rurale* trooper and the six *mozos* bivouacked round the fire outside, thought fit to deposit himself in the upper or second-class compartment with his toes suspended only a few inches from my nose, an attitude probably more pleasant for him than for me in the circumstances. A little grass had been sprinkled over the floor, but my experience, after sleeping on many kinds of beds in many countries, is that in the end and on the whole a lava bed is not to be recommended for a couch.

After a sleepless night we were all glad to rouse our stiff limbs at 3.30 next morning, a couple of hours before sunrise, and jump up whenever the reveille sounded. Two hours later we were saddled in, and by sunrise were well on the way up to the snowline. The view northwards of the crest of Citlaltepētl was quite clear and free of clouds at that hour, and an idea of the scene may be gained from the sketch, Fig. 1. Numerous photos were taken, but none of them proved quite satisfactory in showing both the foreground and distance with equal distinctness. They seemed also to diminish the height of the cone, and the sketch is therefore drawn on a slightly exaggerated scale to give effect to the true angle of slope and the impression of height that was experienced as we made the ascent.

From the camp to the snowline we rode over stony ground with tufts of grass and huge thistles, and at this height, among other plants of alpine facies, one with a strong resemblance to the Swiss edelweiss was plentiful. The edges of old lava streams produced low cliffs, from which glossy blocks of andesitic lava had fallen and lay scattered about. No doubt the slope had been covered by glaciers that produced some of

the moraines lower down, but there were no very conspicuous signs of ice-erosion on this part of the mountain, and no moraines were noticed. Unlike Popocatepetl, which, as I shall afterwards notice, is covered with a thick coating of ash, Orizaba seems, on this side at least, to be quite free of ashes and to have emitted only lava in its last eruptions.

It was as much as the horses could do to carry us up to the snowline, which was reached by 7.30. The accompanying photo (Fig. 23) shows the foot of the snow at about 15,000 feet, and gives the true angle of slope of the upper 3500 feet of the cone, which we found by the clinometer to be from 35° to 42° nearly all the way up.¹ Our Indian guides led us in a bee-line to the summit by the steepest but most direct route. At first we took advantage of spurs of rock projecting radially through the

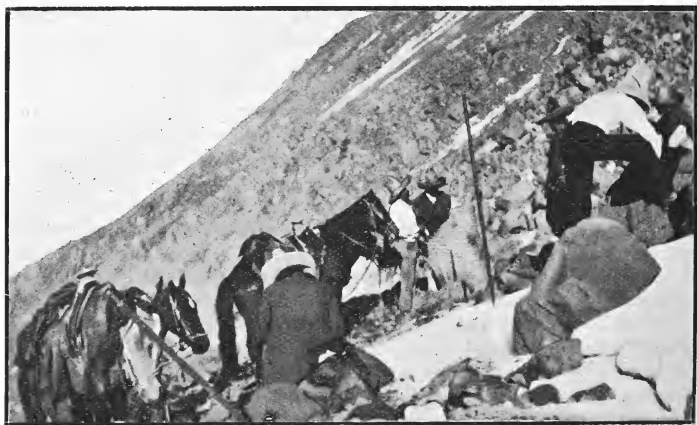


FIG. 23.—Foot of snowline on Orizaba.

snow for the first thousand feet or so, and these gave a good foothold while they lasted. The rate of ascent was a thousand feet per hour at first, but as we ascended the air became so thin and cold that breathing increased in difficulty and progress diminished accordingly. The snow became harder, and it was no longer possible to climb without cutting steps for a foothold. The foremost guide led the way with a spade and made a notch which the man following him deepened with the ice-axe. The last 1500 feet were extremely trying to the strongest of us. I have been across some parts of the Alps, and some of my companions had done mountaineering on the snows of the Rocky Mountains, but none

¹ In Felix and Lenk's *Beiträge zur Geologie und Paläontologie der Republik Mexico* (Leipzig, 1889-1899), pp. 47-49, it is stated that towards the north the angle of inclination of the cone is 45° , and during their ascent in February 1877 from the south, the Mexican engineers Plowes, Rodriguez, and Vigil found in places slopes up to 60° .



FIG. 20.—View of Popocatepetl and Ixtaccihuatl 100 miles distant, and Malinche, from glacial moraines on side of Orizaba at 13,000 feet.
(Drawn by G. Straton Ferrier, R.I., after sketch by Author.)

of us had ever climbed so high as this and breathed an atmosphere so attenuated, the sun overhead beating down on us with all his tropical strength. We had provided against the sunstroke by wearing Mexican sombreros, and against the intense reflection from the snow below us by using goggles, so that our appearance had something of the horrible and awful as the procession moved solemnly upwards. The Indians were clad in Zerapes or blankets, and wore sandals to prevent them slipping, their feet being rolled up in strips of sacking. One of them had neglected to protect his eyes and, poor fellow, they were like balls of fire when in an almost blind state he got home. Accustomed to a comparatively



FIG. 24.—Native guides on summit of Orizaba (Photo by F. E. Wright).

warm climate, it was marvellous how these people endured the cold and tramped along with practically bare feet, the snow squeezing its way between their sandals and their bare soles. They tramped steadily upwards, and it was as much as we could do to follow, as every dozen steps we had to sit down utterly exhausted or lean on our sticks to recover a little fresh energy for the next effort. The other members of the party were all from ten to twenty years my juniors, and I for once wished for the old days when I was able to climb Ben Nevis in an hour and three-quarters, at the rate of 2600 feet per hour, but twenty years makes a good difference to one's mountaineering powers, and the air on Ben Nevis has more oxygen than that on the snows of Orizaba, so I had a little excuse for being the last to reach the top. To climb

that mountain requires a sound heart and strong limbs and lungs, and only a few have the physical ability to reach the summit, which explains the reason why so few ascents of Orizaba have been, or are likely to be, made by white people. (Fig. 24.)¹

With a great effort we all got to the top about one o'clock without a slip, after a climb of five and a half hours. Suddenly we found ourselves on the brink of the great crater. It was bitterly cold and our moustaches were frozen solid, while the biting wind threatened to envelop us in a rising cloud of snow.

The swirling clouds lifted for a short time and disclosed yawning beneath us an awful gulf whose bottom was shrouded in thick mist. The walls were of pale red andesitic lava, and the crater seemed to be about a quarter of a mile in diameter. I was about to creep to the brink for a peep over when the guides pulled me back in terror, indicating that the edge of the vertical precipice was concealed under an overhanging ledge of snow which nobody durst tread on and live. I thought of my happy home and my dear wife and bairns far away as I drew back to a safer place and turned my eyes to a different quarter.

As we gazed eastwards the eye swept over a vast sea of fleecy clouds that almost smothered the whole landscape, but through the rifts the blue waters of the Mexican Gulf could be descried here and there. The cone of Popocatepetl, one hundred miles away to the west, was no longer to be seen through the rolling clouds, and indeed it was clear that the afternoon mists would soon envelop us also if we lingered there much longer. On the highest point a rude cross had been erected long ago by some pious soul, made of iron pipes and a wooden pole stuck into some blocks of ice; but it was badly in need of repair as the accompanying photo will show (Fig. 24). The altitude of the Peak of Orizaba has never been determined by trigonometry, and like that of the other high mountains in Mexico it is variously estimated by different authorities. For long Citlaltepetl was supposed to be lower than Popocatepetl, but I have been on both mountains, and without even a barometer I was quite satisfied that such is not the case. The aneroid we carried unfortunately failed to move above 17,900 feet, long before we reached the top. We probably climbed 500 or 600 feet, and perhaps more, after it became dumb, and no doubt remained in our mind that the summit is not far from 18,500 feet above the sea. Some authorities give the height at over 19,000 feet, but Mr. Flores in his account of Nevado de Toluca, published for the use of the Geological Congress, incidentally mentions 5549 metres or 18,206 feet as the correct figure for Orizaba, and 5450 metres or 17,881 feet for Popocatepetl.

The descent was begun at 1.45, and as this was a more dangerous, although less laborious operation than the ascent, we made use of our ropes, and well it was that we did so as they saved us from the fatal consequences of some slips on the way down the ice-slope. The accompanying snapshot (Fig. 18) shows some of the party preparing the

¹ The first recorded ascent was made in May 1848 by the North American officers Lieutenants Reynold and Maynard (see Felix and Lenk *loc. cit.*).



FIG. 21.—Sierra Negra from foot of snowline on Orizaba.

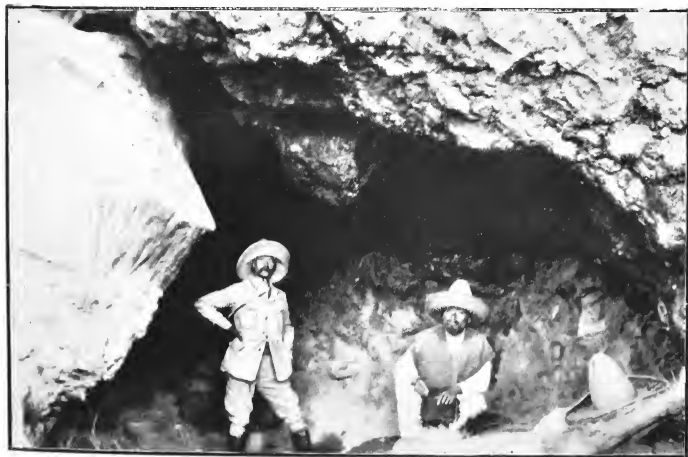


FIG. 22.—Author and guide Augustin in cave on Orizaba.

ropes for the descent. This occupied about two hours. After the upper 2000 feet the dangerous part of the journey was over, and we were able to discard the ropes and slide down the last 1000 or 1500 feet on foot. The horses were awaiting us where we left them in the morning, and very glad we were to get on their backs and scramble down to our cave, which we reached at five o'clock, all very tired and hungry after the long day's work.

Next morning, after another sleepless night in our dismal quarters, we rose at 4.30 and left two hours later, at sunrise, for Chalchicomula, which we reached at eleven after a ride of only four and a half hours. Here we parted with our faithful guide Augustin, who explained in his own language that for white men we had climbed very well. Mexico was reached in the afternoon, and for any one who may wish to follow our track it may be mentioned that the four days' trip, including railway fares, food, guides, horses, and all charges, cost each of us altogether £4, 16s., not more than 24s. per day.

POPOCATEPETL.

Popocatepetl, or the Smoking Mountain, although somewhat lower than Citlaltepētāl, is much better known, and its conspicuous position and commanding height, overlooking as it does the whole valley of Mexico, as well as the traditions which have been associated with it since the days of the Spanish conquest, have given the volcano a world-wide reputation to which the higher peak cannot lay claim. In some ways Popocatepetl is the more interesting mountain of the two. It is not difficult to reach, and although it has not been recently in eruption it has been active in historic times, and is perhaps not yet quite on the retired list.

Many accounts have been given of the ascent and pictures published of the majestic cone and its surroundings, but most of these descriptions are exaggerated in several particulars. A short description of the volcano, as it appeared to me and my companions last September, may be interesting to readers of the *Scottish Geographical Magazine*, in which Mexican geography generally has hitherto occupied a very small place.

When Cortes arrived in the Valley of Mexico in 1519, Popocatepetl was in eruption, and the first attempt of his gallant cavaliers to reach the crater, under Captain Diego Ordaz, was baffled by the volumes of smoke and cinders that assailed them as they neared the summit. The exploit was, however, a great one even for those days of chivalry, and in commemoration of it the Emperor Charles v. allowed Ordaz to assume a burning mountain on his family escutcheon.

Two years afterwards Cortes, who was not satisfied with the result, sent up another party under Francisco Montaña, a cavalier of determined resolution, in order to obtain sulphur for the manufacture of gunpowder. The mountain was then quiet, and the Spaniards, five in number, climbed to the very edge of the crater, which was found to be elliptical in shape and more than a league (or $2\frac{1}{2}$ miles) in circumference. The depth was from 800 to 1000 feet, and a lurid flame burned gloomily at

the bottom sending up sulphurous steam which, condensing on the side of the cavity, coated them over with a layer of sulphur. Lots were cast, and it fell to Montaña himself to descend in a basket into the hideous abyss in quest of the coveted mineral. He was lowered by his companions 400 feet down the precipitous walls, and the operation was repeated until he had collected sufficient sulphur for the wants of the army. (Prescott, Book III. chap. viii.)

The records of eruptions since that period are apparently not very complete. A. de Lapperent, in his *Traité de Géologie*, states that, following a period of rest of sixteen years, there was a small eruption in 1539, after which the volcano seemed quite extinct. But in 1664 it again vomited out ashes for several days, since when it has remained quiescent.

According to Aguilera and Ordóñez, the oldest lavas of Popocatepetl were olivine basalts. These were followed by hypersthene andesites, which predominate, and the latest lavas are trachytes, the last eruption being marked by a thick bed of ash.

Volcanoes are usually found in the vicinity of the sea or large lakes, but those of Mexico supply numerous notable exceptions to this rule. Popocatepetl is situated 44 miles south-east of Mexico City and about 135 miles from the Gulf of Mexico, the nearest water being the shallow lagoon of Chalco, more than 20 miles to the north-west.

On the 24th September I left Mexico City with two geologists from Finland, Dr. Victor Hackmann and Dr. Walter Wahl, of Helsingfors University. The Interoceanic Railway, a single line on the metre gauge, on which we travelled as far as Amecameca, runs south-eastwards across the plain and past Lake Texcoco, a shallow sheet of water with an indefinite shoreline merging at the edge into shallow pools and partly submerged grassy meadows, on which large flocks of cattle and sheep were grazing. The line then turns southwards among the numerous little volcanic cones of the Santa Catarina group, in the vicinity of which isolated hills are scattered about whose configuration shows them to be due to explosions of ash unaccompanied by lava flows. The line leaves the plain, and gradually rising passes through a beautiful country with flat fields below the volcanic slopes on the left, and isolated cones covered with trees on the right. After a thirty-six miles' run we reached Amecameca, a small town on the plain below Popocatepetl 8570 feet above sea-level. The railway journey only takes a couple of hours, and by starting early it is possible to do the trip in two days; but the mountain is not always clear of clouds, and so it is advisable to have a day or two to spare. We found comfortable quarters in the little Hotel Hispaniola Americana, where horses, guides, and provisions were obtained. As visitors are fairly common, we had none of the trouble in making arrangements that occurred at Chalchicomula, and it was not even necessary to have the protection of a *Rurale*, as murders are now comparatively rare, and the excellent rule of President Diaz has made the road up Popocatepetl quite safe during daylight at least.

Leaving Ameca at 9.30 next morning the road, like that to Orizaba, led upwards through cultivated fields of barley and wheat with barrancas



FIG. 25.—Crest of Popocatepetl from Tlamacas.



FIG. 26.—Sulphur Ranch of Tlamacas (12,987 feet).

whose vertical sides showed strata of alluvium, stones, and beds of white pumiceous ash. The trees in the forest zone were at first firs of the spruce family with large upright cones, mixed with a considerable quantity of cypress and only a few pines such as I have noted elsewhere. The pines increased as we ascended, and 1200 feet up the forest zone the firs diminished until none were left, and the forest was one of pure pines chiefly of the Montezuma variety, with three needles in each sheath and short dumpy cones. I examined a large number of these and found that in several cases there were on the same twig tufts of two, three, four, and five needles, showing apparently that the botanical division, according to the number of needles, is not of universal application, or perhaps that these high-growing trees may be the remaining parents from which the differentiated species have originally sprung. Many of the trees near the top of the forest zone were dead and blasted, standing gaunt and bare or lying bleached with the storms of years. Thunderstorms are of daily occurrence in the summer months, and some of the stems had been recently ripped up by lightning, and no doubt this is the cause of much of the destruction of these high forests. The bleached and blasted stems formed quite a feature in the landscape and were conspicuous miles away among the dark foliage of the surviving pines. The forests cease on the north side of Popocatepetl at 13,200 feet, and the ground at that height becomes covered with a thick coating of black ash on which many old trees are growing. There is a good path all the way up to the Sulphur Ranch at Tlamacas, where we halted for the night. The ranch is situated at 12,987 feet, a short distance below the upper limit of trees, in an open, shallow glen at the foot of a tree-covered ridge on the north side of the cone. (Fig. 26.)

It was here that General Ochoa distilled the sulphur collected from the interior of the crater, and six small cast-iron retorts with some brick flues and a chimney-stalk are all that now remain of his refinery. This dangerous but at one time lucrative industry has not been carried on for the last twenty years, but the wooden sheds adjoining the refinery, although rather leaky overhead, are still useful as a shelter for visitors to the crater. The ranch is about fifteen miles by road from Ameca. The road is a good bridle-path, and after a delightful ride of six hours through the flowery forest we reached the night's quarters three hours before sunset, in time to get shelter should the usual afternoon's rain come on.

Before the mist rolled up and enveloped the great cone above us we had time to look round and take some photos and sketches. On the south the snow-capped summit towered in dazzling whiteness over a broad bare pedestal of black ashes deeply furrowed with barrancas into which the snow projected in sharp tongues like glaciers. The ridge on which we sat was the continuation of a huge rugged spur of reddish lava running up to the snow like a pyramidal buttress, and known as the Pico del Fraile. This view, taken from a sketch I made from the ridge above Tlamacas, is given in Fig. 25.

Towards the north in the opposite direction was the sharp profile of the ridge of Ixtaccihuatl seen end on, whose forest-covered base lay

wrapped in fleecy clouds which entirely hid the plain beneath. Some loud claps of thunder warned us to seek shelter, and at six o'clock the clouds rose and sent us down to explore the interior of the sulphur ranch of Tlamacas. The shed was divided by a partition into a smaller and a larger compartment, in the former of which was a capacious arched brick fireplace about 3 feet square with an iron chimney pipe running up through the roof, and a raised platform of boards broad enough to sleep on across the end of the apartment opposite the fire. The *mozos* soon filled the hearth with blazing logs, and we cooked our primitive supper in the clay pots they had brought up, but the chimney was far too small to vent the smoke and it rolled out in pungent volumes and escaped through the openings in the shaky roof. The larger or second-class compartment was occupied by the *mozos*, who kindled a fire in the middle of the floor and slept comfortably round it, while the thunder rolled and the wolves howled dismally in the darkness of the cold nocturnal air outside, making us feel thankful for the shelter this rude hut afforded. The rain which was falling was kept off our bedstead by an inner roof of boards a few feet above it, and with the blankets we had brought up and some dry grass below us, we lay down to rest.

Next morning, after a sleepless night, we rose at five and by six were mounted and ready for the climb. The trail led over a *barranca* cut through red stratified lavas and breccias covered with the black ashes of later eruptions. Beyond this was a steep ashy slope with tufts of grass, thistles, and scanty vegetation above the forest line, and as we ascended the thin air became very trying for our horses, which had to stop and rest every dozen paces. The mean height of the snowline on the north side of the cone is 14,272 feet, according to the most recent measurements by Aguilera and Ordóñez, about 1000 feet above the upper limit of trees, and 1375 feet above the ranch. The horses were left at La Cruce, a ridge of brown lava on which a cross is erected to mark the death of a man on the mountain. The number of such gruesome landmarks tells a sad tale wherever one goes in Mexico, as it is the custom to set up a wooden cross by the roadside wherever a murder has taken place, and some I noticed were quite recently erected, in the mining districts, but those on Popocatepetl were not numerous. At La Cruce the horses were sent back, and we proceeded on foot up the ashy slope to the snowline, a climb that took about an hour. The snow was very soft, and all the way up there was no difficulty in obtaining a good footing. We saw nothing of the jagged spikes and columns of ice described by Brocklehurst in the marvellous sketch accompanying the description of his ascent in 1881. This sketch, and others in his interesting book, *Mexico To-day*, are gross exaggerations of the actual scenes they depict,—scenes I had opportunities of studying on several occasions.

The snow-slope was between 30° and 35° most of the way up, and on this occasion our guides, unlike those on Orizaba, took the easier zigzag course. The edge of the snow was reached at 8.30, and in three hours more a whiff of sulphur vapour announced that the top of the great crater was at hand. At 11.30 the abyss suddenly opened in front

of us in all its grandeur, and we sat down to rest astride the brink and gazed in silent awe into the fearsome pit.

The air was clear and cold, but I did not experience much of the extreme difficulty in breathing and exertion that made the Orizaba climb so trying on the previous week. Indeed, after Orizaba the climb up Popocatepetl was child's play. The time taken to ascend the snow-slope was $5\frac{3}{4}$ hours on Orizaba against 3 hours on Popo, and as the snow began at about 15,000 feet in the former case and at less than 14,000 in the latter, there remained in my mind absolutely no doubt that Orizaba is much the higher mountain of the two. But, on the other hand, it is only right to mention that while I climbed to the very top of Orizaba, the summit of Popocatepetl—the Pico Mayor—was several hundreds of feet above the part of the crater lip where we halted. The altitude of the summit is given by Messrs. Aguilera and Ordóñez at 17,881 feet, which is no doubt the most correct estimate that has as yet been made of the height of this mountain.

The view from the crater was, it need hardly be said, truly magnificent, but not equal to the view I have also seen of the snows of Everest and Kinchinjunga from the Tiger Hill above Darjiling. A vast sea of fleecy clouds covered the whole country far beneath us, but away to the east through this misty ocean there rose like a lonely island the huge dark cone of Malinche, and still further off the snow-crested peak of Orizaba could easily be distinguished on the horizon a hundred miles or more away. The view of Orizaba from Popocatepetl did not, however, seem nearly so striking as that of Popocatepetl from Orizaba given in Figure 19, probably because of the clouds that concealed all the intervening plain on the day of our visit. As we gazed over this cloudy expanse towards the north-northeast a remarkable flat brown patch appeared in the air like a cloud in shape, but quite unlike one in hue. It seemed much too high for land, and the only explanation that suggested itself was either that it was a cloud of dust from some unknown volcano near the coast, or that it was a mirage by which the land appeared lifted up by refraction of the air far above its natural height. As no volcanoes were known to be active in that quarter the latter explanation seemed to be the more feasible of the two.

Turning towards the crater, which was free of clouds and perfectly visible, the walls were seen to be made up of thick beds of red volcanic rock with vertical faces and low ledges between them on which the snow was lying in patches, while fringes of great icicles hung over the jagged projections. The precipice under the Pico Mayor showed signs of two sets of eruptions, as the lower strata were at one place cut off by an upper set of beds lying obliquely across their edges and dipping in a different direction in the way geologists describe as an unconformability. From the face of this precipice, as well as on the opposite edge of the crater, vapour was rising from cracks, but the strongest of the fumaroles was deep down in the bottom of the crater, and here the pale cloud ascended in great puffs under considerable pressure. As it circled upwards the sulphur condensed in a dull yellow skin on the face of the dark red lava, and this, combined with the white snow, patches of which reached down

to the margin of the brilliantly green crater lake in the centre, produced a most remarkable combination of colour and weird scenic effect. The vapour at times bursts out with explosive force, and I even noticed it rising in a column above the summit, from Soltepec, a place on the railway about sixty miles away. The crater lake is round in shape and intensely green in colour, and is situated at a depth of 1640 feet below the highest point of the rim. The crater itself, oval in plan, is about 2000 feet by 1300 feet in diameter at the mouth. Round the lake there is a talus slope, and as we sat on the rim we could see and hear stones and rubbish being constantly precipitated on to it. When Brocklehurst visited the volcano in 1881 the sulphur was being worked, and gangs of thirty men lived for four weeks at a time in the bottom of that infernal hole, the only access to which was by a rope attached to a winch on the brow of one of the cliffs, at the lowest part of the rim about 600 feet above their huts at the side of the lake. This extraordinary industry had then been carried on for twenty years by General Ochoa, and the hardy Indian "Volcaneros" did not seem much the worse, the only bad effects being that their teeth were liable to wear down and their clothes to rot with the sulphur fumes. They worked in alternate gangs, it is true, 100 men being employed altogether, but it is not surprising that, in spite of the extra pay and liquor they received, there was a difficulty in obtaining labourers for carrying on that dreadful industry in the fearsome throat of the smoking mountain.

The descent from the crater was an easy and delightful ride, and the only fault it had was the short time we were in the saddle. We had three guides, one for each of us, and three mats or pitates for steeds. These were doubled up so as to make a comfortable toboggan for two people. The Indians sat in front with their sticks to prevent a run away, and their European passengers behind, with legs spread out and heels in the air. Off we sped one after the other at four or five miles an hour, and in fifteen minutes landed in the soft snow near the ashes. So soft was the snow near the foot of the slope that we sank into it and had to wade almost up to the knees down the last fifty yards. An hour's quick walk took us back to the ranch for dinner. By two o'clock we mounted our steeds for the homeward journey, and galloped into Ameca at a quarter past six, returning next morning to Mexico City after three nights' absence from headquarters.

GEOGRAPHICAL NOTES.

EUROPE.

The Sierra Nevada and the Alpujarra.—The *Boletín de la Real Sociedad Geográfica* (tom. 46) publishes a very interesting contribution on this little-known region which offers an almost novel field to the tourist. Parallel and to the south of the Sierra Nevada is a lower range, the Contraviesca, and between the two lies the valley of the Alpujarra. Beyond this second range lies the sea. It will be remembered that when Boabdil abdicated, the Catholic kings made over to

him and his heirs this very country. When the unfortunate monarch passed by the Ultimo Suspiro del Moro, where he looked back on his beloved Granada and wept, he skirted round the Sierra Nevada and made his way to Andarax in Lower Alpujarra, where he settled down. In a short time he was driven out for state reasons, and finally went over to Fez, where he lived many years, and died like a gallant gentleman in the battle-front. This district has therefore some interest for the historian. The valley has not yet been opened up by proper roads, nor by railway. Beyond one carriage road connecting Ugijar with the eastern boundary, the only means of communication are bridle paths, and travelling is neither easy nor comfortable. Alarcón, indeed, quotes a current proverb: *Cada uno tiene su modo de matar pulgas* (each one has his way of killing fleas). That was at Orgiva, the principal town in the district.

The usual route for the Sierra Nevada is from Granada to the Collata de Veleto, the Col and starting-point for the Picacho and Mulahacen; thence to Capileira, a little village on the southern face, in the upper Alpujarra. From this point the tourist works round to Lanjaron, and so back to Granada, a tour of four days. But this route just skirts the Alpujarra. The author, on the other hand, left the line of rail at La Calahorra, a little south of Guadix, and striking to the right, crossed the Puerto de la Ragua, an old mule-track, or as we might say, a drove-road, which took him to Ugijar. It was by this pass that all the traffic was carried on towards the north in the days before the railway. Then by bridle-path he went to Orgiva and Cadiar, where Aben-Humeya was crowned during the rising of the Moriscos. Cadiar is on the threshold of the upper Alpujarra; from thence the start is made for the peaks, and from this point the ascent of the Contraviesca is most easily undertaken. The height of this range is not half that of the Sierra Nevada, and the latter is seen to great advantage from the lesser heights. To approach the great peaks, either Trevez or Capileira must be the final halt, Capileira by preference for the Picacho, Trevez for Mulahacen. In either case the distance is six hours to the summit, from whence again to Granada is a matter of six or seven hours.

As compared with the Pyrenees, the Sierra Nevada is shorter and not so deep, and, on the other hand, Mulahacen is higher than Mont Perdu. Indeed the Sierra Nevada ranks next to the Alps in altitude. But while the Pyrenees and the Alps resemble each other in general features, the more southern range is widely different, more entirely Spanish; the scenery tends to be bleak and arid, vegetation is scarce and stunted, and water is scarce. The general aspect is grim and forbidding. The attraction lies in the views from the heights. Towards the sea, on the rare occasions when the atmosphere is propitious, the mountains of Africa are plainly visible, and the traveller gets a magnificent view, but mostly when the mountain tops are clear the horizon is enveloped in mist. Towards the north, on the other hand, on a clear day one can see even as far as the Sierra Morena, while lying in the valley underneath is Granada plainly visible.

The author indicates that a project has been in the wind for a light

railway from Granada to the crest, and this, with proper hotels, would open up a very interesting district to the tourist. The map which accompanies the paper is rather exasperating, for while professing to have been got up expressly, it misses out half the place described, so that the reader has to supplement it by an ordinary map. There are excellent photographs of the Sierra Nevada.

Glaciation and Volcanic Deposits near Rome.—In the *Atti della Reale Accademia dei Lincei* for 16th December, Signor Dainelli contributes an interesting note on the geology of the upper reaches of the Aniene, to the east of Rome, beyond Subiaco, in the Sabine Mountains. He has discovered here distinct evidences of glacial action in the basin of Filettino, pointing to two periods of glaciation, the first traces being at an altitude of about 1400 metres, the other at 1650. There is thus a difference of 250 metres between the two deposits, and this corresponds closely with a similar condition in the Balkans, where there are traces of two periods of glaciation separated by a distance of 250 metres. Dainelli does not think it possible at present to make synchronous comparison, as Cvijić has attempted, between these glaciations and those of the Alps, as it is still uncertain whether the former belong to the two periods of Riss and Würm (as recognised in the Alps) or to two stages in the period of Würm. Of not less importance is the result of a microscopic examination made by the author of the substance of the moraine corresponding to the second glaciation. He found that the material was volcanic, and from its composition evidently proceeded from the Lazial volcanoes, the craters of the Alban Mountains, proving that the period of activity of these volcanoes coincided with the second glaciation.

The History of the Scandinavian Flora.—We have received from Dr. Gunnar Andersson a pamphlet on the history of the development of the flora of Scandinavia, consisting of a paper which was read in abbreviated form before the International Botanical Congress at Vienna in 1905, and is published in full as a separate from the *Proceedings* of the Congress. The paper discusses in detail the characters of the flora during the Interglacial periods, and during the late quaternary period, as determined by the various plant deposits found in peat moors and elsewhere. The details are somewhat beyond our scope, but the paper is of special interest in that it includes a series of very valuable illustrations showing various plant formations as they exist at the present day in the Scandinavian peninsula, as well as some sketch maps showing the distribution of certain dominant species. Some of these figures give very interesting and characteristic views of the existing conditions in Scandinavia, so markedly contrasted in some respects with those which exist in Scotland.

The French Census of 1906.—In the *Revue Française* for March 1907 there appears an article giving an analysis, with maps, of the results of the last census in France. On March 4, 1906, the total population of France was 39,252,267 persons, as against 38,961,945 in

1901. This gives an increase, in the five years' period, of 290,322 persons, as against an increase of 444,613 for the period 1896-1901. During the last twenty-five years there has been a steady though not uniform fall in the rate of increase, and since 1872 the total increase has been only a little over three millions. On the other hand, in the last quinquennial period the population of Germany has increased by over four millions, a figure which represents the increase in France for nearly half a century. The author also emphasises the rapid rate of increase in England and even in Italy, though here the increase is masked by the high emigration figures. The tendency in France for the population to accumulate in the large centres is well marked, but yet the cities of Lille, Bordeaux, Roubaix and Toulouse now show a diminution of population as compared with 1901. This is one of the indications that in France the attractive influence of the great cities is in process of being checked.

Perhaps associated with the slow increase of the native-born is the large percentage of foreigners in France. In 1906 there were more than a million, giving a proportion of 25 foreigners to 1000 of the total population. No other nation in Europe, it is stated, has so large a percentage. In Germany there are only 8 or 9 foreigners per 1000 of the total population. Since the naturalisation law of 1889 the number in France has, however, been diminishing, and the figures for 1906 show a decrease as compared with those for 1901. This law made naturalisation compulsory on certain categories of foreigners residing in France, and has thus raised the number of natives as compared with foreigners. In sum, then, the 1906 figures, like those of preceding censuses, tend to show that in France the birth-rate is steadily falling, without any corresponding drop in the marriage rate. The slight excess of births over deaths is due to the constantly falling death-rate. Since 1890, when both were 22 per 1000, the two rates have been approximately equal. The author of the article, M. Cilvanet, draws the usual conclusions from the figures in regard to military matters, and also quotes from M. Bertillon a somewhat interesting statement in regard to the peoples speaking the great European languages. If a French author, says M. Bertillon, addresses himself to all those speaking his native tongue he can only count upon a total public of 46 millions, if a German author does this his public includes 100 millions, while an English-speaking writer has before him 120 million persons who can understand his mother tongue. One would add, however, that it is not only the number of persons speaking it which make a language worth knowing.

AFRICA.

The Colony of Erythrea.—Italy has for some years been endeavouring to check the stream of emigration to America, which is considered by many statesmen to be depleting the mother country without corresponding benefit. Many legislators have looked to their own colony of Erythrea, on the east coast of Africa, as a suitable outlet. The Co-operative Society of Ravenna, (*Società cooperativa dei lavoratori della*

terra di Molinella e di Ravenna) which has done such good work in the Campagna, has been conducting experiments in Erythrea, and lately a commission was sent out to inquire into the results. The *Bollettino dell' Emigrazione*, No. 16, 1906, contains a very exhaustive statement of the opinions arrived at. The objects of the commission were to find out if the climatic and other conditions were favourable to the employment of white labour, and if so, to acquire a tract of 10,000 hectares as a base for progressive colonisation for, say, 200 families. The commission finds that below 1800 metres the climate is not suitable; that over 2000 metres is too cold for the industrial plants, but that between these two altitudes the climate is as salubrious and as suitable for agriculture as any in Italy. They were, however, met with this serious difficulty, that while there is abundance of such land, it is already occupied by the aborigines. These natives have no system of rotation of crops. When one district is exhausted, they leave it to nature for several years and flit to another, and they are thus exhausting the country and destroying the forest land. The first suggestion, therefore, is that the Italian Government should check this nomadic instinct, and insist on the natives learning proper methods. In this manner the free government land would be allotted to white settlers, who would cultivate and restore it to proper condition.

The wheat grown from indigenous seed is excellent, but the native methods of growing it are very faulty. With good selection of seed, as good wheat can be raised as any in Italy.

The Abyssinian cattle are highly spoken of, and only require careful breeding and care. The same applies to the sheep and to the mules. The communications are bad, a railway from Massowa to Asmara is much wanted; and therefore the settler is recommended to direct his attention to such industrial plants as Tobacco, *Agave Sisalana*, *Hibiscus cannabinus*, Cotton (especially Upland), *Sansevieria Ehrenburgiana*, and *S. guineensis*, and other textile plants which are of comparatively small bulk. A full and complete list of these plants is given in the text, and careful experiments are being carried out at Asmara and elsewhere.

It is considered, then, that the colony of Erythrea is, with the limitations indicated, quite suitable for the Italian labourer if the Government will seriously take the matter up. Moreover, below 1800 metres there is ample room for the raising of many valuable crops with the aid of native labour. One drawback is the excessive cost of transport to Italy. The Navegazione Generale Italiana is not only subsidised by the State, but is protected from outside competition by heavy anchorage taxes at Massowa. This ought to be amended.

It will be borne in mind that many authorities do not believe in Erythrea as a permanent settlement for Italians. They hold, among other things, that if the ordinary labourer is planted down in the midst of a black population, he will intermarry, and so give rise to a degenerate race of half-breeds.

Welwitschia and Climatic Change in Damaraland.—A short article by Professor H. H. W. Pearson in *Nature* for April 4 on the curious coniferous plant first discovered by Welwitsch in Damaraland,

and named after him, contains a note on possible climatic changes in this region which is of geographical interest. In the course of an expedition from Walfisch Bay to Winhoek, Professor Pearson found the plant abundant in the littoral desert, and was able to make some observations on the method of fertilisation and so forth. In the nursery at Okahandya he was also able to study some young seedlings, which in the wild state have hitherto been sought in vain. The plant, as all botanists know, is a low-growing species with all the features of a desert form. Growth is slow, and the duration of life prolonged. The seedlings showed a relatively rapid elongation of the root, the object evidently being to enable the plant to tap an underground source of water as soon as possible. Surface water is scanty and infrequent here, and Professor Pearson suggests that the apparent failure of natural reproduction in a region which is well suited to the adults means that the climate is becoming drier, and that the conditions necessary to start germination are less frequent than formerly. Evidently the species is losing ground, which at least suggests change in climatic conditions, and this is believed to be probable on other grounds.

AMERICA.

Inter-Oceanic Canals in Colombia.—The *Boletín de la Real Sociedad Geográfica* (tom. 46) contains an article by Dr. Novoa Zerda of Bogotá advocating a canal between the Pacific and Atlantic oceans which will pass through Columbia. Readers of Mr. Leonard Petre's book (reviewed here, xxii. p. 637) will remember the description of the manœuvres which led to the secession of Panama from Colombia, and the consequent loss to the latter republic of any participation in the Panama Canal scheme. The Colombians felt themselves badly used by the United States, but Mr. Petre considers that the faults were not all on one side. In looking therefore at the present suggestion it will be borne in mind that the writer is influenced not a little by his patriotic feelings. The scheme is that in place of a route through Nicaragua, which has been mooted, a waterway should be engineered by way of the rivers Atrato and Truando, communicating by canal and "tunnel" with Humboldt Bay on the Pacific. There is also an alternative route higher up the Atrato. The details are fully given, showing a large saving over the Nicaraguan route, and asserting that the harbour accommodation would be superior, and moreover that there would be less risk of the locks being upset by earthquakes.

This scheme is by no means new, having been gone into by competent engineers from America many years ago. The article might have been more convincing had the writer's hostility to the United States been less apparent. Petre says of the Atrato, that it "has a very long stretch of stream navigable by steamers, and even at Quibdó it is 250 yards wide and 12 feet deep. Unfortunately, like other rivers reaching the northern coast, its mouth is closed to ocean steamers by a shallow bar where it falls into the Gulf of Darien." The writer of the paper does not dwell upon this bar, nor does he make it clear what kind of tunnels he proposes to construct for ocean steamers. An excellent map accompanies the article.

Rate of Recession of Niagara Falls.—As is well known, of late years the power of Niagara Falls has been largely used for engineering purposes. This has involved such considerable modifications in the amount of water going over the Falls, that there is little doubt that henceforth the conditions of erosion of the gorge will be greatly modified. Now the rate of erosion here has always been a favourite subject of investigation for geologists, and Mr. G. K. Gilbert has returned to it with the object of making a final determination up to 1905, that is, before the altered conditions have had time to make themselves felt. He publishes his results in Bulletin No. 306 of the United States Geological Survey. Apart from the actual problem of the numerical rate, the pamphlet is of great interest in that it gives a series of diagrams, sketch maps, photographs, reproductions of some of the earlier sketches, etc., which serve to give a good idea of the actual changes of form which have occurred in the period under consideration, that from the first accurate investigation by Europeans until the present day. Mr. Gilbert finds that the rate of erosion of the Horseshoe and the American Fall is very unequal. His calculations give for the period of sixty-three years from 1842 to 1905 a rate of about 5 feet per annum for the Horseshoe Fall, but during this period the rate was not uniform throughout, the recession between 1842 and 1875 being apparently less than that between 1875 and 1905. During the period 1827-1905 the rate of recession of the American Fall was less than three inches per annum. No attempt is made to estimate the time taken by the Falls to recede from Lewiston to their present position, because in the author's opinion the rate of erosion has varied greatly both from time to time and also from point to point of the gorge, so that the whole period could not be estimated without taking into account a great number of facts.

A somewhat similar investigation has been undertaken by Professor J. W. Spencer, who recently gave an account of his results to the Geological Society of London. Professor Spencer estimates the present rate of recession of the crest-line of the Falls at 4.2 feet per annum, and believes that this rate has approximately obtained for 227 years. Calculations of the earlier rate lead him to the conclusion that the entire age of the Falls is 39,000 years.

POLAR.

The Anglo-American Polar Expedition.—Letters published in the *Bulletin* of the American Geographical Society for April give definite information in regard to this expedition, whose exact position has hitherto been in doubt. An undated letter from Captain Mikkelsen, probably written in September or October last, reached the above Society on March 9. It was written from Flaxman Island, on the north-east coast of Alaska, in about 146° W. long., and about 240 miles west of the Mackenzie delta. As already mentioned, the *Duchess of Bedford* was towed round Point Barrow by a whaler, but early in September the leader came to the conclusion that it would be necessary to winter at Flaxman Island instead of attempting to prolong the journey further. The expedition has collected sufficient evidence to make the

existence of land to the north of Alaska highly probable. The existence of this land has already been suggested by Sir Clements Markham and Dr. R. A. Harris. The question was to be investigated in detail in the field by the expedition early in the present year.

The ethnologist of the party, Mr. Stefansson, has also written to the American Geographical Society. He is stationed near the Mackenzie delta, which he reached by travelling down that river and not by the sea-route.

Prince Charles Foreland, Spitsbergen.—Dr. Wm. S. Bruce has arranged for a second expedition to Prince Charles Foreland, Spitsbergen, in order to continue the work he began there last year whilst in company with H.S.H. the Prince of Monaco on board his yacht the *Princesse Alice*.

The object of the expedition is to endeavour to complete the topographical survey of the island and the investigation of its geology, fauna, and flora; also to carry on as far as possible the hydrographical survey in Foreland Sound and in the vicinity of the coast, one object being (should weather permit) the sounding out of the edge of the continental shelf. Dr. Bruce has for his assistants Mr. J. V. Burn Murdoch, who has had extensive experience of survey work in Siberia, Korea, Manchuria, Japan, and South Africa, Mr. Stewart Ross, M.A., and Mr. Gilbert Kerr, formerly piper of the *Scotia*. Mr. Burn Murdoch left Edinburgh on May 19, following up the scientific instruments, equipment, and stores which left the previous day, by Messrs. James Currie and Co.'s steamer *Bernicia*, who assisted the expedition by carrying them to Newcastle, whence they were transferred to the steamer *Venus* for Norway. Mr. Burn Murdoch proceeded by the same steamer. Dr. Bruce and the rest of the staff left Edinburgh on May 27. From Tromsø a special steamer has been chartered which leaves that port on June 5, and is expected to land the expedition on Prince Charles Foreland on about June 8. The point of landing aimed for is towards the south-end of the east coast in the vicinity of Sea Horse Bay, but should the ice be fast in Foreland Sound and the Channel in consequence unnavigable the expedition will have to land at Black Point or on the west coast. The expedition will finally be relieved and brought back to Europe by H.S.H. the Prince of Monaco on board his yacht the *Princesse Alice*. This is the third expedition which has set out since January from the Scottish Oceanographical Laboratory. It is the eighth time that Dr. Bruce sails to the Polar regions.

COMMERCIAL GEOGRAPHY.

The Water Supply of Egypt.—A dispatch from Lord Cromer containing an account of the proposed raising of the Assuan dam, with the object of increasing the water supply of Egypt, has been issued by the Foreign Office as a Parliamentary paper. Sir William Garstin is of opinion that no other project, except raising the dam, will have the desired effect, and suggests that it should be raised by about 23 feet, at an approximate cost of £E1,500,000. It is estimated that the present supply of water is only about a quarter of that which will be ultimately

required, and the proposed addition will more than double the existing supply, raising it from 980,000 cubic metres to 2,300,000 cubic metres. It is proposed that the additional supply be entirely devoted to the benefit of Lower Egypt to the north of Cairo. The effect of the proposed alteration will be to submerge the temples on Philae Island during the winter, and these temples will then be only exposed during the months from July to October. The idea of moving the temples has meantime been abandoned.

Niger Railway.—According to the *Temps* of May 1, M. Roume, the Governor of French West Africa, has inaugurated a further section of the above railway from Konakry to the Niger. The line has now reached the river Kukure, and it is expected that it will be finished as far as Kumi, near Timbo, by the end of the year. This place has been chosen for the site of the Central Station, and for the future capital of Guinea. It is hoped to complete the whole railway by 1910.

GENERAL.

We have received an intimation to the effect that considerations of health and family reasons have compelled Professor Emile A. Goeldi to resign his position as Acting Director of the Museum of Natural History and Ethnography at Para, Brazil. In terms of his contract, Professor Goeldi has the right to appoint a successor, and has chosen his colleague, Dr. J. Huber, chief of the Botanical Section. The State Government has conferred upon Dr. Goeldi the title of Honorary Director, and has appointed him delegate representing the Museum at the International Congress of Geography at Geneva, as well as at some other coming Congresses. Professor Goeldi intends to associate himself with the University of Berne, and to continue there his work on the Natural History and Ethnography of the Amazon area. Dr. Huber proposes to continue the administration of the Museum along the lines laid down by Dr. Goeldi, with whom he has been associated for nearly twelve years.

EDUCATIONAL.

AN article in the *National Geographic Magazine* for March on Railway Routes in Alaska may be recommended to teachers as affording material for an interesting lesson on the evolution of means of transport, and the conditions which determine the direction of the evolution. The article is illustrated by a striking series of sketch maps, and contains much that is exceedingly suggestive from the point of view of commercial geography. Alaska is a country in which, owing to the nature of the climate, the agricultural resources are almost *nil*, and its rapid development of late years has of course been due to the discovery of its mineral wealth. From the nature of the climate and of the surface transport is a matter of great difficulty. A considerable mileage of navigable rivers does occur, but these are only available during the warmer months of the year. Between the rivers and the terminal regions the most economical form of transport, apart from railways,

which are as yet few, is by sledging. The result is the rather curious fact that goods carried up the rivers in summer have to wait till winter to be carried to their destination, unless very heavy summer freight charges are to be paid. In consequence it is being found increasingly necessary to supplement the navigable rivers by railroads. As yet Alaska only contains two hundred miles of rail, but for the full development of its mineral resources—gold, coal, and copper—further lines are required. A great difficulty, however, is that the region whose mineral resources promise to justify railway construction lies between the international boundary and the 154th meridian, and this region is separated from the Pacific seaboard by a number of parallel mountain ranges which form the Pacific Mountain System, and which must be crossed before the interior is reached. The author considers the different possibilities in regard to this traverse, and shows that the political and commercial factors are such that the route which from the point of view of topography only seems the logical one, is apparently ruled out of court. The great interest of the paper, then, from the point of view of commercial geography, is that it illustrates, by a practical example, the fact that the route of lines of communication is determined by more than one set of factors, and not by the topography alone. Further, the author's conclusion that the facts meantime available are not sufficient to determine the best route for immediate construction, and that the problem will probably be practically solved by the wasteful method of experimentation, followed by a struggle for existence among competing lines, suggests some interesting geographical morals.

A short article in *The Journal of Geography* for January 1907 by R. H. Whitbeck on the points which should be emphasised in the teaching of the geography of Europe, contains some points worth note. The central idea is that in going over the geography of a continent with a junior class it is a mistake to employ a rigid scheme, giving in each case a fixed amount of time to physical features, commerce, and so forth, according to the methods beloved of old-fashioned text-books, but that the teacher's aim should be rather to emphasise those points in each case which are of prime importance, and are characteristic of the nation or country discussed, while slurring over the others. Thus in the case of Great Britain, Germany, and Belgium it is the factors which have made for the predominance of the industries of these nations which are of importance. Greece, Italy, and Spain, on the other hand, are given as examples of countries whose greatest interest lies in their past history, Russia of one in which it centres in the life and struggles of the people. The recommendations, of course, virtually resolve themselves into the giving in every case of a vivid impressionist sketch, and the danger—a danger which we have seen exemplified in some recent American geographical elementary text-books—is that the personal equation enters so largely into the sketching process that the result may have little or no objective value. It not infrequently happens in such cases that a concise impressionist statement about a place or country, once formulated, is repeated in text-book after text-book long after it has lost all the truth it ever possessed, and it is unfortunately true also that these general state-

ments, believed in from early youth on an original basis of authority and not of reason, are precisely those which have the longest life.

Some of the general points in regard both to the continent of Europe and of the individual countries here stressed are, however, of real value : as, for example, the emphasis laid upon the great irregularity of the European coastline as a factor in the commercial development of the continent ; on the many and scattered mountain ranges as leading to the existence of numerous, relatively small, and independent states ; and on the exceptionally mild climate of the northern portion. We note further with approval that the author regards as the primary danger in geographical teaching that of attempting to teach too much.

NEW BOOKS.

EUROPE.

Moorish Remains in Spain ; being a Brief Record of the Arabian Conquest of the Peninsula, with a particular Account of Cordova, Seville, and Toledo. By ALBERT F. CALVERT. London : John Lane, 1906. Price 42s. net.

The Alhambra. By ALBERT F. CALVERT. Second edition. London : John Lane, 1907. Price 42s. net.

As Mr. Calvert truly says in his preface to one of these volumes, he has supplied a long-felt want. He describes how, when he came to study the architecture of the Alhambra, he found that there was no illustrated work which dealt adequately with the subject and which at the same time was accessible to the general public. Costly volumes there were hidden away in public libraries, histories also in Spanish and Arabic, but these were not within the reach of the ordinary reader. He therefore made a special study of the history of the Arab Domination, sifting the various authorities, and only retaining the most trustworthy. He considers, for instance, that the authors most worthy of credence are Gayangos, the translator of the manuscript of Al-Makkari, and Dr. Dozy of Leyden ; and he omits, probably quite justly, the work of Conde, *Los Arabes en España*. Conde, however, did have access to the manuscripts in the Escorial, a privilege which was denied to Gayangos. In dealing with the artistic side of his subject, Mr. Calvert has made diligent use of the work of Owen Jones and others.

Very wisely, we think, the author has made the letterpress subservient to the illustrations, for while the volumes will be acceptable to all who are interested in Spain, they appeal more directly to the student of design and the architect. Mr. Calvert has not only used the camera himself, but has levied contributions on all the best illustrated works, and, as a result, has produced two volumes of great interest. The historical *résumé* should be thoroughly mastered in order to comprehend the artistic evolution. One of two points at once strike the reader. The length of time during which the Arab domination subsisted, "a period elapsed equal to that which passed since England was subjugated by the Normans ; and the descendants of Musa and Tarik might as little anticipate being forced into exile across the Straits . . . as the descendants of Rollo and William may dream of being driven back to the shores of Normandy." All told, the period lasted from 710 to 1610.

Another point which is well brought out is the dramatic suddenness of the Arab conquest. Tarik landed on a foraging expedition. He found the Peninsula to all intents and purposes empty ; the Visigoth power, a worthless exhibition of

brute strength, had sunk into sensuality and helpless decay, and the land and its wealth were at the mercy of the first invader. "Unworthy of remembrance" Hallam stigmatises the Visigoths, and so they fell. So also eventually the Arab conquerors quarrelled among themselves, fell into luxury, did not, so to speak, keep their armour burnished, and they, too, in their turn were swept from the land. It is a dramatic story told with considerable force, and it forms a fitting prelude to the beautiful illustrations of Moorish art.

Mr. Calvert found that to most people this artistic evolution meant simply the Alhambra; that to them there was little else worthy of note, forgetting that it is not even the best example, but is typical rather of the decay of the Moslem power. Therefore he has published a second volume dealing with Toledo, Seville, and Cordoba, showing, for instance, that the Alcázar at Seville is finer than anything in Granada, and justly extolling the mosque at Cordoba, which strikes one as the most wonderful thing in all Spain. The reader, after mastering the general history, might do well to reverse the order of the books and commence with Toledo and the severe beauty of Cristo de la Luz and Sta. Maria La Blanca. Then Cordoba and its mosque would lead up to the Alcázar at Seville, which in its turn would form a fitting introduction to the Alhambra.

"Dios hizo la Alhambra y Granada
Por si alguna vez se cansaba de su morada."

"God made the Alhambra and Granada, lest at any time He might tire of His own Dwelling-place."

In dealing with the authors whom he consulted, Mr. Calvert takes occasion, as we have said, to mention how much Gayangos was hampered by an illiberal policy which closed the library of the Escorial to him with all its valuable manuscripts, and it is pleasant to read that Alfonso XIII. has shown a more enlightened tendency, and has removed all restrictions which might stand in the way of research.

We may express the hope that Mr. Calvert will be encouraged to continue his studies of the many other Moorish remains which are less well known.

The Sacred Grove, and other Impressions of Italy. By STANHOPE BAYLEY.
London: Elkin Mathews, 1907. Price 4s. 6d. net.

Many of these papers have already appeared in the *Times of India*, others are now printed for the first time. Mr. Bayley has evidently lived much in the country and has got into touch with the people. The reader will find in the pages before him the indefinable charm which he meets in the country itself. It is not the mere beauty of the scenery, nor indeed any one aspect; it is the curious feeling which so many have that everything is strangely familiar and is not being seen for the first time. Many will read the paper on the Madonna of Venice with peculiar interest, and the description of that wonderful old Byzantine mosaic in the church at Murano will find an answering echo in many a heart. Ruskin felt this influence, and regretted that the figure was so hidden by tawdry cloth hangings; but whoever has once looked into that face will not soon forget the impression produced.

"A runic inscription in Venice" tells of one of the lions at the Arsenal which bears an inscription recording the name of Harold the Tall, who afterwards as King of Norway fought with our Harold, and was killed at Stamford Bridge shortly before the battle of Hastings.

All travellers who love their Italy will read this little volume with reminiscent pleasure.

Three Vagabonds in Friesland. By H. F. TOMALIN. With Photographic Pictures by ARTHUR MARSHALL, A.R.I.B.A., F.R.P.S. London: Simpkin, Marshall, Hamilton, Kent and Co., 1907. Price 7s. 6d. net.

Friesland is the north-western province of the Netherlands, and is bounded on the north, west, and south by the Zuyder Zee, and on the east by the provinces of Groningen and Drenthe, a somewhat unusual but very accessible place for a summer holiday, as "a man may dine in London and lunch next day in Friesland."

The author of this work describes it very accurately as "a book of photographs with letterpress obligato," and we may say at once that the photographs are excellent. The three vagabonds spent a very enjoyable holiday, entering the country at Stavoren, and making their way in a Dutch boat over the meers, or, as we might call them on the analogy of Norfolk, the broads, until they reached Leeuwarden, from whence they returned homewards. They met with no startling or exciting adventures, and had to live for the most part on eggs, cheese, and vegetables. Throughout the whole of the expedition they received much simple courtesy and kindness, and they present to us a very pleasing portrait of the Dutch peasantry. The excellent photographs, however, are the feature of the book.

Winter in Schweden. *Wegweiser des Schwedischen Touristenvereines*, No. 28. Stockholm: Wahlström and Widstrand.

This is a small pamphlet to be had gratis on application to the Swedish Tourist Club, Stockholm, which, by the aid of letterpress and many photographs, sets forward the winter charms of Sweden. Many of the illustrations are exceedingly striking, and the list of possible winter sports seems long.

ASIA.

The Tourists' India. By EUSTACE REYNOLDS-BALL, F.R.G.S., F.R.C.I. London: Swan Sonnenschein and Co., Limited, 1907.

The author of this book, while admitting that the output of books on India of late years has been enormous, describes it as "a conspectus or popular sketch of the present-day topographical, archæological, historical and social aspects of the great show cities and tourist centres of India." As a series of sketches it is eminently readable and entertaining, although it contains nothing new. It runs on much the same lines as Mr. Perceval Landon's *Under the Sun*; i.e. we have a number of light sketches of the principal cities of India, with Mandalay, Colombo, and Aden thrown into the bargain. Bombay is disposed of in eight pages, Agra in nine, Amritsar in five, Udaipur in six, and so on. There is also an appendix of Practical Information for the Tourist, ranging from the Mohammedan Calendar to cures for snake-bites. The illustrations are good, and there is an useful map.

The Desert and the Sown. By GERTRUDE LOWTHIAN BELL. London: Heinemann, 1907. Price 16s. net.

Arab and Druze at Home. By WILLIAM EWING, M.A. London and Edinburgh: T. C. and E. C. Jack, 1907. Price 5s. net.

The Desert and the Sown is a delightful book. From the time that in Miss Bell's company we cross "the great bridge across the Jordan with its trellised sides and roof of beams," we breathe the atmosphere of the East. First, it is that of the Desert: at least so do we call it, but not so the Arabs. "To them it is neither desert nor wilderness, but a land of which they know every feature, a

mother-country whose smallest product has a use sufficient for their needs. They know, or at least they knew, how to rejoice in the great spaces and how to honour the rush of the storm." Still, as in the centuries gone by, "the ghazu (plundering raid) is the only industry the Desert knows, and its only game."

From the Desert we pass to the Mountain, the home of the Druzes, that people in whom we British have never lost interest since, in 1860, Lord Dufferin was sent to reconcile the vendetta of Christian Maronite and of Mohammedan Druze, and succeeded in saving the chiefs of the latter from being treated as scapegoats by the Turkish authorities, who were really responsible for the continuous anarchy which led to the outburst that deluged the Lebanon with blood. Not but that the Druzes themselves are a fighting and a fiery race. Listen to the wild song in which war is, so to speak, declared by the Mountain upon the Desert, by Druze upon Arab :

"Upon them, upon them ! That our spears may drink their hearts !

Let the babe leave his mother's breast !

Let the young man arise and begone !

Upon them, upon them ! O Lord our God ! that our swords may drink at their hearts."

The descriptions, though short, stamp themselves on the memory. There is Damascus, "swept by the clean desert winds, with the finest Arab population that can be found anywhere, the descendants of the original invaders, who came upon the first wave of conquest and have kept their stock almost pure." It is the only world-renowned city which has remained "as important under the rule of Islam as it had been under the Empire of Rome." There is Haleb or Aleppo, "at the beginning of the great Mesopotamian flats, slowly dying for want of an outlet to the sea." There is Kalb Lozeh, halfway between Aleppo and Antioch, with its great church, "not only the last word in the history of Syrian architecture, spoken at the end of many centuries of endeavour, but the beginning of a new chapter in the architecture of the world. The fine and simple beauty of the Romanesque was born in North Syria." Lastly, there is Antioch itself: "Earthquakes and the changing floods of the stream have overturned and covered with silt the palaces of the Greek and of the Roman city: the town has shrunk away from the castle walls; but it is still one of the loveliest of places, with its great ragged hill behind it, crowned with walls, and its clustered red roofs stretching to the fertile and wide valley of the Orontes."

The object of the book is not political, but there is much in it which deserves to be pondered by us British, whose sovereign rules over so many Mohammedans, who have such an enormous stake in the East. We ought to notice, for instance, such a judgment as this on Turkish policy. "The Turk can organise a village community, but he cannot govern on wide lines; above all, he cannot govern on foreign lines, and unfortunately he is brought more and more into contact with foreign nations. Even his own subjects have caught the infection of progress. . . . And yet for all his failure there is no one who would obviously be fitted to take his place. For my own immediate purpose, I speak only of Syria. . . . Of what value are the pan-Arabic associations and the inflammatory leaflets that they issue from foreign printing presses? The answer is easy: They are worth nothing at all. There is no nation of Arabs . . . the Syrian country is inhabited by Arabic-speaking races all eager to be at each other's throats, and only prevented from fulfilling their natural desires by the ragged half-fed soldier who draws at rare intervals the Sultan's pay." And again, what can be more characteristic of the "tremulous" East than this which follows? "It is scarcely

an exaggeration to say that if an English (*sic*) regiment is cut up on the borders of Afghanistan, the English (*sic*) tourist will be mocked at in the streets of Damascus. Islam is the bond that connects the western and central parts of the continent, as it is the electric current by which the transmission of sentiment is effected, and its potency is increased by the fact that there is little or no sense of territorial nationality to counterbalance it." Finally, with regard to the increase of British influence in the East in the last few years, the author notes that, as far as she can judge, the change is due "to Lord Cromer's brilliant administration in Egypt, Lord Curzon's policy on the Persian Gulf, and the alliance with the conquering Japanese."

In conclusion, it is marvellous how this lady, with an insignificant escort, travelled half the length of the Ottoman Empire and was treated with universal respect and civility. It reminds one of Kinglake's remark that Damascus is more tolerant and safer than Oxford. There is indeed much in *The Desert and the Sown* that recalls *Eothen*, and Miss Bell's work shares in the charm of that most fascinating of books of travel.

Mr. Ewing's book is less ambitious, but is clearly written and gives valuable information on Trachonitis, Mount Gilead, and the country east of the Jordan. The Circassians who have emigrated thither are likely, according to the author, to make good colonists; "in their agricultural enterprises they are protected by their reputation for absolute fearlessness, unwavering energy in avenging an injury, and skill in the use of their weapons." Comparing the Arabs and Druzes as warriors, he admires the simple daring, wild bravery, and personal intrepidity of the Beduins, while acknowledging that in power of united action and stubborn endurance the Druzes have the superiority. "There is," he adds, "a strain of true nobility in the character of that people, who in the hour of victory have ever chivalrously protected defenceless women and little children from all injury and insult." This book can well be read as a pendant to *The Desert and the Sown*.

A Mission in China. By W. E. SOOTHILL, Author of "The Student's Pocket Chinese Dictionary," translator of the Wenchow New Testament, etc.
London and Edinburgh: Oliphant Anderson and Ferrier, 1907. Price 5s. net.

This is an account of the Methodist Free Church Mission Station at Wenchow, in Eastern China, detailing the daily life and work of the missionary propagandist.

As is stated in the preface, the book is written chiefly for those who lend their support to such missions, and in our view their judgment, after perusal of the book, should undoubtedly be—to put it on a commercial plane—that in Wenchow at any rate they are getting value for their money.

There is a spirit of earnest optimism in the account which, to some extent, disarms criticism, but which optimism seems to us hardly warranted by the results accomplished after a quarter of a century of patient labour; but it is perhaps we who expect too much. Of matters of Geographical or Ethnological interest in the book there is practically none.

There is a chapter on opium—not very conclusive, except that it shows how, if the Indian drug were excluded from China to-morrow, the evil would still be there, as it would simply stimulate the further extension of the poppy cultivation in China. The last five chapters of the book are devoted to a condensed but very lucid exposition of the religions of China, and is perhaps the most interesting portion of the volume to the general reader.

The author is evidently an enthusiastic believer in the ultimate triumph of the Christianisation of China, and his linguistic achievements in Chinese, if

equally attained by his brethren in the mission-field, will go far to make that objective a little nearer realisation than it seems to be at present.

Indian Pictures and Problems. By IAN MALCOLM. London: E. Grant Richards, 1907. Price 10s. 6d. net.

Yet another book on India! But this work is not of the pot-boiler stamp, of which we have had far too many of late years. The ex-member for Stowmarket presents for the consideration of his readers a series of "Indian Pictures and Problems," in which his breadth of view, his sympathy with official and native, his impartiality and his enthusiasm, are all abundantly evident. And yet withal he does not pose as an authority; he sees and sketches with commendable clearness some of the problems which beset the British administration of India, but he offers no nostrum of his own by which every one of these problems is to be solved. He has seen for himself the sagacity, skill, energy and statesmanship of the men on the spot from the Viceroy down to the junior police officers, and he has come to the deliberate conclusion that the future weal or woe of our Eastern Empire is and should be in their hands rather than in those of the India Office or the House of Commons. He has given special attention to the condition of affairs and the complexities of the problems which constitute the difficulty of the north-western frontier province, and Anglo-Indians will recognise the impartiality with which he sets forth the policies of the conflicting schools of politicians. Mr. Malcolm is evidently a keen sportsman, and endowed with a keen sense of the beauties of nature, as well as with the ability to convey to his readers a satisfactory picture of what he has seen. He has a number of good stories which lose nothing by the way he tells them. We recommend this work to our readers as one of the best which have appeared on India during the last decade.

AFRICA.

The Sudan: A Short Compendium of Facts and Figures about the Land of Darkness. By H. KARL KUMM, Ph.D., F.R.G.S., with an Introduction by the late Mrs. KARL KUMM (née LUCY GUINNESS). Illustrations, Maps, and Meteorological Tables. London: Marshall Brothers, N.D. Price 3s. 6d. net.

The main, indeed the only, reason for publishing this book is to awaken interest in the Sudan from a missionary point of view. It well fulfils its purpose. The author has travelled widely in the Sudan, and gives an accurate contribution to our knowledge; it is brief, and if it cannot claim any great depth, still it may the more readily arouse interest. Dr. Kumm's first chapter, "Here endeth the Second Lesson," is, we think, the best call to a missionary life which we remember to have read, at any rate for many a long day. The number of missionaries in the Sudan is very small—as far as we can make out from the statistics given, fourteen women and thirty-seven men, belonging to four missionary societies, but no Roman Catholic missionaries are mentioned, so far as we can see.

Useful notes are given on the waterways and details respecting the navigability of the rivers in Nigeria. The bibliography of the Western Sudan is fairly complete, and the meteorological tables are of real value. A small book of this nature must perforce be somewhat sketchy, but from the point of view from which it is written it is quite good, and will doubtless be read widely in missionary circles, and should appeal forcibly to their self-denying efforts. Dr. R. F. Horton writes a very sympathetic preface to the volume and heartily commends it. The illustrations, though of interest, are not all equally well produced. The small map is clear, but of no geographical importance.

The Guide to South Africa, for the Use of Tourists, Sportsmen, Invalids, and Settlers. 1906-1907 Edition. Edited annually by A. SAMLER BROWN and G. GORDON BROWN. London: Sampson Low, Marston, and Co.

We noticed the last edition of this useful little guide in volume xxii. p. 168, and have only to repeat our former words of praise for its compact arrangement and the amount of information it contains.

The Natives of British Central Africa. By A. WERNER. ("The Native Races of the British Empire" Series.) With 32 Illustrations. London: Archibald Constable and Co., Limited, 1906. Price 6s. net.

Mr. N. W. Thomas and Messrs. Constable are doing an Imperial service in publishing a series of volumes which Mr. Thomas is editing, entitled "The Native Races of the British Empire," thereby seeking to spread a knowledge of the dark-skinned races under the British flag. In the preface the editor calls attention to the well-known but little appreciated fact that the Berlin Museum has ethnographical collections at least ten times as large as those of the British Museum, though only twenty-nine years have been given to the work. It is surely a very humiliating fact to record that British anthropologists have to go to Germany to study the various races under our flag! Again, he says that it is probable that the money necessary for the study of savage races will not be forthcoming until those races are extinct! Can nothing be done to make Britain rouse herself? Truly we lag far behind our contemporaries, and that we shall bitterly regret our inertia when it is too late, is certain.

This series of books is not intended to be too technical in character, but to give a readable and graphic account of native races, which ought to awaken a more popular interest in the subject, so that "the man in the street" may have a clear idea of the peoples over whom he rules. Mayhap, if he could be induced to take up a book of such vital and important interest, he might be induced to take cognisance of higher literature than the record of racing odds and cup-ties. For Government officials, too, this series is of great importance. As is well known, millions are squandered and thousands of lives lost through the crass ignorance of those sent out to rule and work amongst races which cannot be understood offhand.

We turn now to the very interesting and well-illustrated book. It is easily read, but yet gives a clear and comprehensive account of the country, people, their religion, habits and customs, factions, language, government, and folklore, and all with commendable brevity, in less than 300 pages, although no point of real importance has been omitted by the author.

The statement on page 124, that no European has witnessed initiation ceremonies, though incorrect, may be excused. Mr. Crawford Angus, a corresponding member of our Society, published a very full account of the initiation dances, but this was read before a German anthropological society. Father H. B. Barnes has also described these dances, but the paper was only read a few months ago at the Anthropological Institute, and has not been published.

To refer to this "initiation" for a moment, we could learn a lesson from these so-called savage folk. When boys and girls arrive at a marriageable age they are taken apart, and, by means of ceremonies and instruction, taught the meaning of life and the duties of husband and wife, so as to prepare them for the future. An admirable custom, though perhaps somewhat crudely carried out in this primitive state of society. Our own young people suffer much from the lack of such instruction. A book of this sort, full of facts, is not adapted for reviewing by

making extracts. It must be read from cover to cover, and we can promise our readers that they will be well repaid. Author, editor, and publisher alike are to be congratulated, and we trust the series so well begun will maintain the high level reached by this volume. If so, this series will render a very real service to the Imperial cause so many of us have at heart, and which more would uphold did they in the least comprehend the inheritance and the responsibilities which are ours.

Sport and Travel: Abyssinia and British East Africa. By LORD HINDLIP,
London: T. Fisher Unwin, 1906. Price 21s. net.

In this volume we have a pleasantly written and interesting account of three expeditions made by Lord Hindlip for the purposes of sport. The first was in 1902, when he and an American friend, Mr. Waterhouse, went to Abyssinia, where, entering the country at Zeila, they made their way to the capital and had an interview with King Menelik. From him they got permission to proceed south to Lakes Zuai, Margherita, and Chamo, which they circumambulated, keeping first on the eastern shores and returning by the west. At one place they were not far from Lake Rudolph. Lord Hindlip, who unquestionably is an expert, pronounces Abyssinia proper but a poor country for sport. Incidentally we learn from him a good deal about the tyranny and oppression of the government and the wretched condition of the population—nothing strictly new, but valuable confirmation of the reports of other travellers. For the scene of his second hunting expedition Lord Hindlip selected British East Africa. Arriving at Mombasa in the middle of January 1903, he took train to Fort Ternan not far from the Kavirondo Gulf on Lake Victoria Nyanza. His first attempt for elephants at Kericho was a failure, so he went north to Eldoma Ravine and Baringo, where big game abounded, and there he succeeded in securing many additional trophies for his collection. Another expedition to Mount Sirgoi to the north-west was equally fortunate, as, in addition to finding rhinoceros, Lord Hindlip secured his first lion. The tract round Mount Sirgoi has, according to Lord Hindlip, an absolutely perfect climate, most suitable for colonisation, with abundance of extensive plains suitable for sheep and cattle rearing and for the cultivation of various grains. This was the tract offered some time ago by the Foreign Office to the Zionists.

In May 1905, Lord Hindlip returned to Eldoma Ravine and Sirgoi, accompanied by Lady Hindlip, and was again successful in getting good sport and his first giraffe. From the vicinity of Mount Sirgoi the party proceeded through swamps and floods towards Mount Elgon, and Lord Hindlip secured his first elephant, which, to his unmitigated disgust, turned out to be a female. Crossing the Turkwell river, they found themselves in the Karamojo territory of the Uganda Protectorate. Owing to want of time Lord Hindlip, after a few days at Kelim on the north of Mount Elgon, retraced his steps across the Turkwell and marched along the eastern slopes of Mount Elgon, where game was found to be plentiful and several fine specimens were secured. He gives a very interesting account of the cave dwellings on Mount Elgon inhabited by a somewhat pusillanimous tribe called the Gabumi. Contrary to the current theories, Lord Hindlip thinks the Elgon caves are natural and not artificial. To reach Kisumu, the terminus of the Uganda railway, they marched through the territory of the Kavirondos, an interesting tribe inhabiting a very malarious tract. From Kisumu Lord and Lady Hindlip returned to Mombasa. The main object of these expeditions was, as we have said, sport, and in this Lord Hindlip was very successful. But in addition to many well told and exciting narratives of sport, we have in this

volume acute and valuable observations regarding the country, its resources, and its inhabitants. The numerous photographs which illustrate the book are excellent, and there are also two useful maps. If the work attains to a second edition it would be well to assimilate the spelling of the place-names in the maps and the letterpress.

The Egyptian Sudan. By J. KELLY GIFFEN, D.D. 3rd edition. London and Edinburgh: Fleming H. Revell Company. N.D. Price 3s. 6d. net.

After a very slight sketch of the Egyptian Sudan, Dr. Giffen proceeds to give a description of its present condition and future prospects. He crossed the desert by the military railway in 1900; it is, we imagine, in a more satisfactory condition now than at that time. The book is written from the missionary point of view. Dr. Giffen, with Dr. Watson of the American Mission in Egypt, went with the Rev. A. A. Cooper, of the British and Foreign Bible Society, to view the land in 1899 and find out what prospects for mission work there were. The author points out that it is always much easier to start a mission when some of the young men who have been in mission schools have settled in the neighbourhood. He found them everywhere, and speaks well of the influences which they have exerted. The difficulties of building a mission station and commencing mission work are well described, and readers will gain an insight into this phase of life from the perusal of the book and learn somewhat of the obstacles to be surmounted in entering an uncivilised country in order to spread the Light. The people—the Shullas—amongst whom the work has been begun are depicted in a satisfactory way. The sketch of what the Sudan really is and the prospects of prosperity which may be reasonably looked for, are of much value, as so many think of the country as a wild desert, unreclaimable and unprofitable, not worth the lives and gold which have been paid for it. Readers will be inclined to reconsider this opinion when they lay down this volume. The illustrations are good.

AMERICA.

Highways and Byways of the Mississippi Valley. Written and Illustrated by CLIFTON JOHNSON. New York: The Macmillan Company. London: Macmillan and Co., Ltd., 1906. Price 8s. 6d. net.

In this volume we have a series of sketches of scenery and life in the Mississippi Valley which have already appeared in various magazines in America. The writer has added to each chapter a brief note of suggestions, so that intending travellers may see these regions "with the utmost comfort and facility." A perusal of the book, however, leads us to doubt if even ordinary comfort may be expected in the places described, and certainly the facilities for travel are remarkably few.

A travers l'Amérique du Sud. By J. DELEBECQUE. Paris: Plon, 1907. Price 3fr. 50c.

The author left Panama in September 1904 for an extensive tour through Ecuador and Peru and down the Amazon from its headwaters to the sea. Arriving at Guayaquil, the chief port of Ecuador, he found it unattractive, so pushed on to Quito, the capital, by the railway to Colta, and from thence to Quito by an uncomfortable coach journey of over two days. Quito is situated 2850 metres above the sea, and the atmosphere is fresh and cold. It has neither industries nor hotels, but lately the electric light was introduced. While Ecuador possesses

fewer persons of Spanish descent than any other South American republic, the author insists that South Americans generally constitute a race by themselves, intelligent and acute, but inexact, fond of display, given greatly to exaggeration, incurably lazy, extremely vain, and possessing a contempt of foreigners and an ardent but narrow patriotism. No amount of travelling in Europe ever changes their natural qualities. While the author was at Quito, Parliament met and disestablished the Roman Catholic State Church of Ecuador, and confiscated its funds to supply the wants of the State. The army of Ecuador consists largely of officers and musical bands, but it has instructors sent by Chile. After passing Chimborazo (6250 metres high), first ascended by Edward Whymper in 1880, the author sailed down the Guayas river to Guayaquil, and found that the chief amusement during the sail was shooting the crocodiles, which are seen in hundreds basking on the banks. With modern guns they are easily killed, particularly if hit near the nape of the neck, and their numbers never seem to decrease.

Four days' sailing along the monotonous and ugly west coast of South America brought our traveller to Callao, the port of Lima, the capital of Peru, which he reached by electric tramway. Less picturesque than Quito, Lima is, however, an attractive city, and has a population exceeding 100,000. Its climate is perfect, for cold and extreme heat are unknown and rain rarely falls. Should a tourist appear with an umbrella he will be mobbed and called a "Chilian," which is the worst a Peruvian can say of any one. Otherwise, the manners of the Limans are as gentle and kind as their climate. At the same time, their Spanish blood demands Bullfights. Delightful sea-bathing resorts spread along the coast. French officers now instruct the Peruvian army, which had fallen into disorder and was severely defeated by that of Chile in the war of 1879-81. Foreigners are numerous at Lima, particularly Italians, English and Americans being found at Callao, while Chinese swarm in thousands everywhere with their distinctive racial characteristics of love of labour, and thrift, and dirty appearance. They do not wear pigtaails in Peru.

The most novel and geographically important part of the author's route was his spirited expedition by the "central road of Peru" from Lima across the Andes and through the vast wooded region to the river Pichis and to the confluence of the rivers Pachitea and Ucayali, and from thence down the Amazon to the Atlantic. First he went by train from Lima to Oroya, by the highest railway in the world, which attains an elevation nearly equal to that of Mont Blanc, a railway which does credit to its North American constructors. Mountain sickness is experienced on this railway across the Western Cordillera. Leaving Oroya on horseback on November 23, our traveller crossed the Eastern Cordillera, and it was not till he reached the Amazon watershed that Nature revealed herself in all her tropical beauty. For days he passed through forest while vampire bats attacked his mules by night, but though they lost much blood they were not weakened. Human beings protect themselves by means of mosquito nets.

After a laborious journey over a road in whose mud the mules often stuck fast, the author reached on 6th December Puerto Yessup, on the river Pichis, and the land portion of his trans-continental voyage was at an end. He stepped into a boat which was simply a hollowed tree $5\frac{1}{2}$ yards long, less than a yard broad, less than half a yard deep, and manned by two Indians. Occasionally all had to lie flat to pass under the overhanging branch of a tree, or had to enter the water to remove one barring the way. At last Puerto Bermudez, at the confluence of the Pichis and Chivis, was reached, and there the Franciscan Fathers informed the author that he must employ a certain Irishman named Robert Crawford if he wished to go further. Crawford gave him a boat and steered him downstream while retailing his adventures in Peru and his successful establishment there, and

handed him on to other boatmen until the steamer for Iquitos was reached. By five days' sailing down the Amazon in a good British steamer of the Booth Line the author arrived at Manaus, a city of 50,000 inhabitants and the chief place of export for indiarubber, of which it is really the metropolis, with Booth liners leaving thrice a month for Liverpool and also for New York. In sixty hours Para, at the mouth of the Amazon, was reached. It has 125,000 inhabitants. Having left Lima on 22nd November, the author arrived at Para on 25th January, and concludes his long and arduous journey with the remark that, in spite of many privations, he thoroughly enjoyed it. The maps appended to the volume are poor, but that showing M. Delebecque's Itinerary along the "Central Road of Peru" is valuable as an original contribution to our knowledge of "Darkest South America."

AUSTRALASIA.

The Natives of Australia. By N. W. THOMAS, M.A. London: Archibald Constable and Co., Limited, 1906. Price 6s. net.

This book is the first of the "Native Races of the British Empire" series, which has for its object the diffusion of popular as opposed to technical information regarding the native races of the British Empire. In the volume now before us the author treats of the native races of Australia, and he has put together in an eminently readable form and in a short compass much interesting information regarding the aborigines of the island continent. The work does not claim to be exhaustive. On the contrary, we understand that the writer is preparing a larger general work on the aborigines, for which he invites the assistance of those who have special information on the subject or photographs which might be useful as illustrations. Notwithstanding that so much has been written on the subject, there is still ample room for an exhaustive, comprehensive, and scientific work on the aborigines of Australia, of whom it has to be confessed that much still remains obscure and doubtful as to their antiquity, their origin, their development, their history, and their customs. We are accustomed to speak of them as tribes, but we are apt to forget that the so-called tribes number anything from between two and three score to two or three hundred, and are distributed over an area of something like three million square miles; their movements depend on their food supply, a fact which prevents their settling down for longer than a few months in any one place; each tribe has a distinct language of its own, and that language is liable to change because of tribal customs and superstitions; it has also its own legends, folklore, religious ceremonials, and the like, which it sedulously conceals, partly from distrust and partly from a real, though merely superstitious fear of the consequences of disclosure. The numbers of the aborigines are decreasing rapidly. These notorious facts do not contribute to a prompt or easy elucidation of their former history and present condition and customs; and thus Mr. Thomas has undertaken a difficult and arduous task, in which we may wish him every success. In the meantime, in the work before us, the ordinary reader will find a well-balanced compendium of useful information, collected with considerable trouble and patient research from a variety of sources regarding a difficult and, in many respects, an obscure though interesting subject. The work is embellished by some good photographs.

POLAR.

Life in the Antarctic: Photographs by the Scottish Antarctic Expedition. Cowans' Nature Books, No. 10. London and Glasgow: Cowans and Gray, 1907. Price 6d. net.

We have nothing but unstinted praise for this delightful little book, which

consists of sixty photographs, with a few short notes by Dr. W. S. Bruce. When our most famous caricaturist represents penguins at the *North Pole*, it is obvious that the public still requires education on the subject of the life of the Antarctic region, and at a very small outlay they may now obtain a great deal of information in the pleasantest way. All teachers of geography should include the pamphlet in their outfit, and parents interested in nature study should not fail to get it for their children.

GENERAL.

The Opal Sea. By JOHN C. VAN DYKE. London: T. Werner Laurie, 1906. Pp. 262.

While geography recognises a Red, a Yellow, a White, and a Black Sea, the term "Opal Sea" is purely the creation of the author, who was struck by the fact that "on warm summer days, in tropical regions, the air over the sea at sunrise will be pale blue; at noon, if the heat continues, it will show a trembling, dancing gas-blue; and by three of the afternoon perhaps it is rosy blue or opalescent—something that shimmers and changes like mother-of-pearl. Given such an atmosphere above a smooth water-surface, and the inevitable result is that supreme beauty of reflection, the opal sea." There is no aspect of the sea, whether in calm or storm, which Mr. Van Dyke has not studied, and which he does not describe with great beauty and with scientific accuracy. He gives also an account of the marine fauna and flora and of sea and shore birds, which completes one of the most exhaustive and readable books on the sea which has yet been published. The title of the book is too limited and fanciful.

The Polish Jew: his Social and Economic Value. By BEATRICE C. BASKERVILLE. London: Chapman and Hall, Limited, 1906. Price 10s. 6d. net.

The Polish Jew occurs sporadically in most of our large cities, and some of his characteristics are sufficiently well known, if not admired. This volume affords an excellent opportunity for studying him in the mass and in his natural habitat. The present state of affairs in Russia gives the study more than an anthropological interest: the political interest, indeed, almost overshadows the scientific. The book now before us deals with all sides of the question—economic, historical, and political, and gives evidence of a large amount of study at first hand. The essential question is that of the possibility of real assimilation; whether or not the Jew can become a *bona-fide* citizen of the land in which he dwells. The indications of a satisfactory solution are not hopeful. Recent movements seem even to accentuate the differences between Jew and Pole. The problem is a tangled one, but the presentation of it by the author is as clear as can be hoped for, and will repay study.

The Life of Isabella Bird (Mrs. Bishop). By ANNA M. STODDART. London: John Murray, 1906. Price 18s. net.

The name of Isabella Bird is one which deserves to be remembered among the women of action of this country, and it is well that a record of her life should be preserved. In Scotland, where she spent so many years, and where she had many friends, the present volume will be specially acceptable. Miss Stoddart is a capable biographer. She has made a judicious selection from Mrs. Bishop's correspondence, and the narrative is written with due appreciation and reserve.

Mrs. Bishop's books and lectures have made the public familiar with her travels, and these need not be particularised here. They were made alone, and in spite of periodical ill-health. Throughout the book there is always the contrast

between the retiring, quiet-voiced little lady as she appeared at home, and the fearless and observant traveller, who apart from the actual dangers which she overcame, must necessarily have been able to exercise a powerful influence on the barbarous or semi-civilised peoples with whom she came in contact. The book compels the conviction that Mrs. Bishop was no ordinary personality.

A Junior Course of Comparative Geography, consisting of Course A of "A Progressive Course of Comparative Geography." By P. H. L'ESTRANGE, B.A. With 140 Pictures and Diagrams. London: George Philip and Son, Ltd., 1907. Price 2s. 6d. net.

This is a part of the "Progressive Course" issued for the use of boys between the ages of eleven and thirteen. We have already reviewed the larger work (xxii. p. 619), so it may be sufficient merely to call attention to this volume.

Life by the Sea-Shore: An Introduction to Natural History. By MARION NEWBIGIN, D.Sc. (Lond.) London: Swan Sonnenschein, 1907. Price 2s. 6d. net.

This is a reprint of a little book which has only indirect geographical interest, but will be found useful by sojourners at the seaside.

On the Trail of the Immigrant. By EDWARD A. STEINER, Professor in Iowa College, Grunnell, Iowa. Price 5s. net. New York, Chicago, Toronto, London and Edinburgh: Fleming H. Revell and Co., 1907.

Since the days when Robert Louis Stevenson was an emigrant West, there is —if we are to judge from this book—little in the lot of the emigrant which is changed for the better. The overcrowding, the discomfort on board ship, is much the same, and the feeding and food still nauseating. We are glad to note, however, that Professor Steiner makes an exception in favour of the better accommodation and better feeding on board British liners and emigrant ships; his strictures being mostly directed against the Continental shipping companies. The book is chiefly descriptive of the early stages in the life history of the future American citizen, from the time when he emerges from the land of his nativity—be it Scandinavia or Piedmont, until he is dumped down in Castle Garden, or Ellis Island, New York, and after. We are introduced to German, Russian, Austrian, and Hungarian Jews, Slavs, Greeks, Magyars and Finns, Neapolitans and Sicilians, follow their fortunes from the time the Emigrant is transformed into the Immigrant, and afterwards trace them to their homes and haunts in the great cities of the Republic, and watch them at their work and leisure. In some cases it is a very sad story, and the troubles of the unfortunate aliens seem only to culminate on their arrival on the shores of America. The "Man at the Gate"—the Inspector of the New York Commission of Immigration—makes short work of the "undesirable alien." The poverty-stricken, the lame and the halt, and the blind are bundled back again whence they came. Whilst we may appreciate the motive, we must deplore the method, for some of the scenes depicted as enacted at Ellis Island are very sad. The book is somewhat disappointing in so far that the author hardly follows up the trail in the way the title of the book suggests. The immigrant is studied and exploited in the big cities and towns, but on the thousands who trek west, the rural and agricultural immigrants, little more than a passing glance is bestowed. Also, what is more disappointing to a British reader is the entire absence of any reference to the Irish immigrant, who has played such an important part in the social and political history of the United States.

Professor Steiner treats very exhaustively the comparative value to the community of the different types and nationalities, and some of his conclusions are at variance with what might have been expected from what we know of the undesirable alien as we find him. The student of sociology will find much to interest him in these pages, and if the problems of the future in America which await solution are mainly religious and political, we have no doubt the American people will find their solution possible. There can be no question, however, that there exists in the heterogeneous congeries of nationalities which go to make the citizens of the United States, all the latent elements of a bloody revolution. It also remains to be seen in the event of a struggle, internecine or international, whether these masses arriving in America—half a million annually—would respond with that feeling which we know and designate as patriotism.

The author expresses his views very clearly, and there are fewer Americanisms than might be expected; but why write (page 23) 70's for seventies? The Appendix seems to us very poor in immigration statistics.

Hunting Big Game with Gun and Camera. By WILLIAM S. THOMAS. New York and London: G. P. Putnam's Sons, 1907. Price 9s. net.

This volume contains the record of some very enjoyable but not very exciting hunting expeditions, mostly in Canada. It is profusely illustrated with very good photographs, the work of the author, Mr. Thomas, who in his last chapter descants on the delights of hunting with a kodak rather than a rifle. Our readers have already heard a good deal of this kind of sport from Mr. Schillings and Mr. Hornaday, whose works were reviewed in this *Magazine* only a short time ago.

Elementary Studies in Geography: Our Own Islands. By H. J. MACKINDER, M.A. London: G. Philip and Son, 1907. Price 2s. 6d.

First Steps in Geography. By ALEXIS E. FRYE. Boston: Ginn and Co., 1906.

Like every other science, geography can be entered not merely through forbidden portals but by a Beautiful Gate such as these admirable manuals throw open wide to the young. With the aid of a simple and attractive text, striking illustrations, and plain, clear, intelligible maps the study of geography becomes a pleasure. Mr. Mackinder even summons poetry to his aid in his efforts to arrest and hold the attention of his youthful students and fires their minds with Scott's lines on Flodden, a stanza from the ballad of Chevy Chase, Byron on Lochnagar, and Macaulay's poem on the beacon-fires arousing all England to the approach of the Armada. Mr. Frye (who is first Superintendent of Schools of Cuba) aims more widely by showing Man's relations to Nature throughout the globe, but his book's wealth of pictorial illustrations deprives his subject of all dullness. Works like these disarm the critic, who can only thank their authors for exercising so much skill and ingenuity in converting the geography-lesson in schools from a penance to a delight.

BOOKS RECEIVED.

The Book of Capri. By HAROLD E. TROWER, B.A., British Consular Agent, Capri. With Illustrations. Demy 8vo. Pp. xxviii + 345. Price Lire 5. Emil Prass, Naples, 1906.

The Truce in the East and its Aftermath; being the sequel to "The Re-Shaping of the Far East." By B. L. PUTNAM WEALE. Demy 8vo. Pp. xvi + 647. Price 12s. 6d. net. Macmillan and Co., London, 1907.

The Greatness and Decline of Rome. By GUGLIELMO FERRERO, translated by ALFRED E. ZIMMERN, M.A. Two volumes, demy 8vo. Pp. Vol. I., viii + 328. Vol. II., vi + 389. Price 17s. net. William Heinemann, London, 1907.

The Egyptian Sudan, its History and Monuments. By E. A. WALLIS BUDGE, M.A., Litt.D., etc. In Two Volumes. With numerous Illustrations. Large Demy 8vo. Pp. Vol. I., xxviii + 652. Vol. II., x + 618. Price 42s. net. Kegan Paul, Trench, Trübner, and Co., Ltd., London, 1907.

Statistical Abstract of the World. By HENRY GANNETT, B.S., M.E., LL.D. 24mo. Pp. viii + 84. Price 3s. net. First Edition. John Wiley and Sons, New York, 1907.

From Trail to Railway through the Appalachians. By ALBERT PERRY BRIGHAM, A.M. Crown 8vo. Pp. viii + 188. Price 2s. 6d. Ginn and Company, Boston, 1907.

Rothiemurchus. By HUGH MACMILLAN, D.D., LL.D., F.R.S.E. Illustrated. Demy 8vo. Pp. viii + 145. Price 3s. 6d. net. J. M. Dent and Co., London, 1907.

Red Russia. By JOHN FOSTER FRASER. Illustrated. Crown 8vo. Pp. xii + 288. Price 6s. Cassell and Co., Ltd., London, 1907.

Sark: The Gem of the Channel Islands. Pictured and Described by Mrs. HENRY BOWLES. Large 4to. Pp. 80. Arnold Fairbairns, London, 1907.

Companions in the Sierra. By CHARLES RUDY, with an Introduction by R. B. CUNNINGHAME GRAHAM. Demy 8vo. Pp. 310. Price 6s. John Lane, London, 1907.

To-Morrow in the East. By DOUGLAS STORY. Crown 8vo. Pp. ix + 267. Price 6s. Chapman and Hall, London, 1907.

The Chinese Empire: A General and Missionary Survey. With Portraits and Illustrations. Edited by MARSHALL BROOMHALL, B.A. With Preface by the Right Hon. Sir ERNEST SATOW, G.C.M.G. Demy 8vo. Pp. xxiv + 472. Price 7s. 6d. net. Morgan and Scott, London, 1907.

Limnologia. *Studio Scientifico dei Laghi.* Per G. P. MAGRINI. Pp. xv + 242. Ulrico Hoepli, Milano, 1907.

Wanderings East of Suez. In Ceylon, India, China and Japan. By FREDERIC COURTLAND PENFIELD. Demy 8vo. Pp. xvii + 349. Price 10s. 6d. net. George Bell and Sons, London, 1907.

The Aran Islands. By J. M. SYNGE. With Drawings by JACK B. YEATS. Demy 8vo. Pp. xii + 189. Price 5s. net. Maunsel and Co., Ltd., Dublin.

Also the following Reports, etc.:—

Transactions of the Highland and Agricultural Society of Scotland. Fifth Series. Volume XIX. Edinburgh, 1907.

Cape of Good Hope. Civil Service List for 1907. Edited by ERNEST F. KILPIN, C.M.G. Cape Town, 1907.

Report on the Administration of the Bombay Presidency for the Year 1905-1906. Bombay, 1907.

Imperial Gazetteer of India. New Edition. Vols. I., III., and IV., Descriptive, Economic, and Administrative. Price 6s. net. Clarendon Press, Oxford, 1907.

Report concerning Canadian Archives for the Year 1905. Vol. I. Ottawa, 1906.

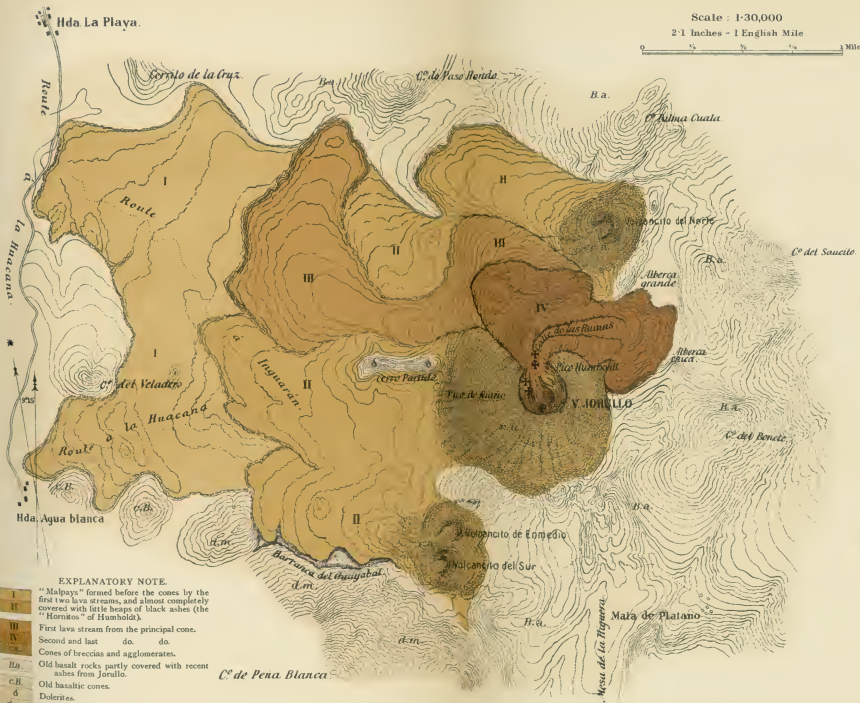
Publishers forwarding books for review will greatly oblige by marking the price in clear figures, especially in the case of foreign books.

GEOLOGICAL MAP OF THE VOLCANOES OF JORULLO BY E. ORDÓÑEZ TOPOGRAPHY BY A. VILLAPAÑA AND A. ANGUIANO

Scale: 1:30,000

2.1 Inches = 1 English Mile

0 1/2 1 1 1/2 2 Miles



EXPLANATORY NOTE.

"Malpais" formed before the cones by the first two lava streams, and almost completely covered with little heaps of black ashes (the "Hornos" of Humboldt).

First lava stream from the principal cone.

Second and last do. do.

Cones of breccias and agglomerates.

Old basalt rocks partly covered with recent ashes from Jorullo.

Old basaltic cones.

Dolerites.

Diorites and Monzonites.

Fumaroles still emitting vapour.

THE SCOTTISH GEOGRAPHICAL MAGAZINE.

ADDRESS TO THE AUSTRALASIAN ASSOCIATION
FOR THE ADVANCEMENT OF SCIENCE,
ADELAIDE MEETING, 1907.¹

By THOMAS WALKER FOWLER,
M.Inst.C.E., M.Am.Soc.C.E., F.R.G.S., etc.,
Hon. Sec. Victoria Branch, Royal Geographical Society of Australasia.

SINCE the last meeting of the Association held at Dunedin in 1904 the event of greatest interest to geographers of our Southern Hemisphere has been the return of the British National Antarctic Expedition from the scene of its labours in Ross Sea and Victoria Land. The detailed account of the expedition has been available for some time, and attentive readers are compelled to admire the courage and determination with which the work of the expedition was carried out—courage and determination well worthy of the best traditions of our race. Captain Scott's farthest point south was $82^{\circ} 16' 33''$, or about 534 statute miles from the Pole. This is about 50 miles less than the distance by rail from Sydney to Melbourne, or 50 miles more than that from Melbourne to Adelaide. To reach this position Captain Scott and his comrades in ninety-three days covered 960 miles—an excellent record for a sledge journey, which, however, was surpassed by that of the same leader, who the following season, when journeying westward with another party, ascended to the great plateau of Victoria Land and covered 1098 miles in eighty-one days, a large part of the journey being at an altitude of 9000 feet in latitude 78° S. In some respects this journey resembles that of Nansen across Greenland in 1888 in latitude $64\frac{1}{2}^{\circ}$ N. He reached practically the same altitude and travelled 282 miles in forty-one days.

¹ Presidential Address, Section E (Geography). Read 8th January 1907.

Captain Scott gives us a vivid description of the pleasures of sledging in Polar regions and enables us to understand more clearly the hardships experienced by the early Polar explorers such as Parry and the Rosses, Franklin, M'Clure, M'Clintock and others, who had not the facilities available to more recent explorers of obtaining warm food.

Commander Peary still maintains his attack on the North Pole, and on 21st April 1906 reached $87^{\circ} 6' N.$ latitude, or about 203 miles from his goal, when he was compelled to retire.

The difference in conditions observed on approaching either Pole is remarkable, and so far no satisfactory explanation has been forthcoming. Whilst Scott's great Southern journey was approximately parallel to the south-eastern coastline of Victoria Land it was over the surface of the great ice-sheet originally discovered by Sir James Clark Ross. The evidence we have tends to show that this ice-sheet is hundreds of feet in thickness, and extending uninterruptedly towards the Pole. Some authorities have suggested that it is of glacial origin, in which case the surface altitude would increase with increase of latitude, but no such increase was observed, neither by Scott during his Southern journey, nor by those whom he sent to the south-east nearly 200 miles for the special purpose of observing the conditions of the ice. As far as is known, the Great Barrier ice is hundreds of feet in thickness (possibly in places reaching one thousand feet) and covers a sea surface. The more northern portion is probably afloat, whilst it seems possible that at the more southerly parts reached by Scott's parties the ice extends to the sea-bottom. In any case the ice surface is certainly not drifting. On the other hand, Commander Peary in extreme northern latitudes met with comparatively thin "floe" ice intersected by open leads and drifting rapidly to the eastward, the more northern ice moving more rapidly than that to the south.

It will be remembered that Nansen in the *Fram* found, as he anticipated, a westerly current to the north of Asia, which he hoped would take him across the Pole, but which actually carried the *Fram* to latitude $85^{\circ} 55' N.$ in longitude $66^{\circ} 33' E.$ The existence of this westerly current in the extreme north beyond Siberia and the easterly current found by Peary north of Grant Land seem to imply the existence of one broad current across the high Polar seas, and that the North Pole itself is covered with water (or more correctly, water-borne ice), since, should a current sweep, say from Behring Strait across the Pole to the meridian of Greenwich, the direction followed by the Asiatic side of that current would be described as westerly, and that of the American side as easterly, although the water streams would be running towards the same point and parallel to each other.

During the year we have been advised of the successful accomplishment of the North-West Passage by Captain Amundsen in the Norwegian ship *Gjøa* after a voyage of over three years. This is the first occasion on which a navigator has taken his vessel from the Atlantic to the Pacific by the coast of North America and its islands; but M'Clure over fifty years ago brought his crew in the reverse direction during the Franklin search, being thus the first to make the North-West

Passage, although he had to abandon his vessel (the *Investigator*) in the ice. The accomplishment of the North-West Passage brings to our minds the names of many gallant navigators and British naval heroes from the days of Queen Elizabeth—Frobisher and Davis, equally at home in fighting icebergs or the Spanish Armada; Hudson and Baffin; James Cook; Parry; the Rosses and Franklin; and many others; whilst the interview between young Horatio Nelson and the Polar bear cannot be forgotten.

Of what advantage is Polar exploration? Why risk human life and treasure in endeavouring to wrest from Nature her secrets in these regions of such desolate and inhospitable character? These questions have been often asked, yet might not similar questions have been asked with reference to Australia when the gallant Sturt returned from his central Australian Expedition? On Sturt's track there now stands one of Australia's most important mining centres, a city of 30,000 inhabitants—the world-famed Broken Hill. On one memorable occasion Sir John Franklin traversed the ice-bound regions of the far North-West America, suffering the greatest possible hardships and having actually to eat his boots to maintain life. What benefit to mankind could such a country be? In it now the miner is hard at work, and Klondyke, the Yukon, and Cape Nome are household words.

Taught by experience on their western boundary, where, through the carelessness of British statesmen of the past, they now find themselves shut out from access to the seaboard, our Canadian fellow-citizens are steadily extending their dominion and the boundaries of the Empire by including the ice-bound islands to their north, and it may be asked whether Australia should not take similar action with reference to these southern seas, its scattered islands, and Antarctica. Apparently valueless at present, are they not possibly future Klondykes?

Independent of the possible future value of these Polar regions to the human race, their exploration and scientific examination produce data of considerable practical value in solving the problems of meteorology and terrestrial magnetism, whilst the work has been noted for its value in developing the best characteristics of British seamen.

As geographical students we are deeply indebted to those explorers who have given us a knowledge of the world's great geographical features, which govern the development of nations and determine their lines of communication. To the Civil Engineer more especially, a thorough grasp of the geography of the country in which his work is located becomes of vital importance, so that he may take advantage of all favourable conditions and guard against or minimise the effect of all unfavourable ones. On the other hand, it falls to the lot of the Civil Engineer to alter or modify geographical conditions. By piercing the Alps he has brought Southern and Northern Europe into close touch with each other. With his barrages, canals, and other irrigation works he has enormously increased the prosperity and productiveness of Egypt and of India, whilst with the Suez Canal he has revolutionised the commercial relations between Europe and the Eastern World. We may therefore note with satisfaction that our American cousins have actively

resumed operations at the isthmus of Panama, and that there is every prospect of the great scheme originated by Lesseps being carried to a successful termination by people of the Anglo-Saxon race. Whilst necessarily this great work will principally benefit American commerce, Australasia cannot fail to profit from it immensely.

Turning to Australia, the prosperity of the South Australian Branch of the Royal Geographical Society of Australasia is a matter for congratulation and pride. Recently the Branch has secured the "York Gate Library," a collection of works of the greatest interest to Australia, and South Australians must be gratified to think that these volumes will for the future be housed in their capital. Whilst we rejoice at the prosperity of the Branch, we sympathise with it in the loss it has sustained through the death of its veteran Honorary Secretary, the late Mr. A. T. Magarey. The Queensland Branch of the Society has also suffered a severe loss through the death of its illustrious President, Sir Augustus C. Gregory, whose name should always, in view of his valuable services in the exploration of the Continent, be a household word amongst Australians. Ripe in years and in honours, he passed away beloved by all who knew him.

After twenty-three years of most arduous and valuable work, the veteran Mr. A. C. Macdonald has resigned the Secretaryship of the Victorian Branch of the Society, and I have been elected his successor. I take this opportunity of testifying to the zeal and energy with which Mr. Macdonald has always worked to promote geographical research throughout Australia.

Recently some Victorians have claimed that the country between the Murrumbidgee and the Murray is legally a portion of Victoria as defined by the Separation Act, under which it was established as a Colony. Personally I cannot agree with this view, as, whilst at one time the Port Philip District did extend to the Murrumbidgee, the boundaries were then clearly defined and described as, *inter alia*, following that river, so that when the Imperial Parliament, in constituting the Colony and describing the boundaries, excluded all reference to the Murrumbidgee and referred to the Murray alone, it deliberately and intentionally fixed the boundary between New South Wales and Victoria as at present accepted. An examination of Australian history in connection with that boundary shows that an injustice has been done to the memory of the first native Australian explorer, Hamilton Hume, who, during his memorable journey from the New South Wales settlements to Port Philip, discovered and crossed Australia's greatest river in November 1824 at Albury, and named it the Hume in honour of his father, A. H. Hume. Captain Sturt in 1829 followed the Murrumbidgee down to its junction with Hume River (which had not in the interval been traced below Albury), entered the latter, and followed it to its mouth, calling it the Murray after Sir George Murray, a distinguished officer who had served with credit in the Peninsular Wars and was at the time presiding over the Colonial Office. By right of priority Hume's name should stand, and be applied to the whole course

of the river from its source to its mouth in Encounter Bay. The New South Wales Government gives a partial recognition to the original discoverer, marking the stream as the "Murray River (or Hume River)" on the official maps. Our Geographical Societies might with propriety unite in asking their respective Governments to restore the original name.

The work of the Australian pioneer explorer is drawing towards a close, and the problem of utilising and settling the interior becomes of increasing importance. The search for gold has been a great stimulant to exploration, and the interior of Western Australia, formerly a "terra incognita," is now covered with a close network of travellers' tracks.

Conservation and utilisation of the limited water supply and economical means of transport are the great essentials for the development of the interior. Artesian and semi-Artesian wells have been most effectual in providing an insurance against drought in parts of Queensland. New South Wales and South Australia and the storages of Barossa and Beetaloo with their reticulations must be of great value to those supplied.

The Barcoo or Cooper's Creek and the Diamantina provide occasional supplies for the northern portions of South Australia, but as far as I can gather these streams are too wide and shallow to permit of useful storages being constructed in view of the enormous evaporation. The particulars supplied by travellers as to the Macdonnell Ranges, however, would indicate that in that locality sites suitable for the construction of enormous water storages of considerable depth can be found, and no doubt will be utilised when the country becomes more developed. In this connection the journals of Mr. Teitkins and of the Horn Scientific Expedition, and Mr. Arthur Giles's paper read before the Victorian Branch of the Royal Geographical Society of Australasia in 1902, are most suggestive.

In Victoria extensive works for irrigation and water conservation have been projected and are in part carried out, and these will provide a fairly satisfactory safeguard against future droughts, and in New South Wales similar works are projected. Whilst these works will necessarily be of immense benefit to the area supplied, I sympathise strongly with the South Australian view that the interests of the Murray (or as we may term it, the Hume) navigation should not be completely sacrificed to those of irrigation. For its area, the valley of the Hume and its tributaries is the most fertile region of Australia, and whilst the commerce of its more eastern parts can be more economically dealt with by rail from the adjoining seaboard, the river itself forms the natural outlet for the lower portion. Hence the locking and canalisation of the Hume and its tributaries, the Darling and (possibly also the lower Murrumbidgee) are works in which we as geographers are deeply interested. These works to be successful must be carried out to provide the maximum depth for navigation possible, since to secure economical transport (whether by rail or water) the goods must be handled in large quantities as otherwise transit expenses increase enormously.

To reap full benefits from the river navigation the entrance must be

thrown open to the shipping of the world so that vessels of the largest size may pass in and out. The importance of such navigation has been recognised elsewhere, as in the cases of the Danube and the Mississippi, where very large sums of money have been expended to secure the desired results. Compared with these instances the conditions at Encounter Bay seem much more favourable, and in view of experience elsewhere the problem should be comparatively easy. Sooner or later this important work, which will facilitate the drainage of valuable lands, will be carried out.

In recent years the waters of the Southern Hemisphere south of 40° S. latitude have frequently been called the "Southern Ocean," and Professor Gregory in his presidential address to this section at Dunedin, whilst approving of the name, advocates its application to the expanse of waters south of "a line passing from Tierra del Fuego, through South Georgia to Cape Colony, thence approximately along the parallel of 36° S. latitude to the south-western corner of Australia. The Southern Ocean washes the whole southern shore of Australia, and may fairly be extended to include all the Tasman Sea. It runs down the western shores of New Zealand to South Island, and thence runs southward to the Antarctic Continent near Cape Adair, at the point where the Atlantic Coast type of Wilkes Land joins the Pacific Coast type of Victoria Land. The whole Pacific is one geographical unit. It is bounded entirely by coasts of the Pacific type, and if we limit the Southern Ocean to the great ocean belt that extends from South America past South Africa to New Zealand, that also may be regarded as an independent geographical unit bounded by coasts of the Atlantic type." I confess that I cannot follow Professor Gregory's reasoning. The American coastline of the Pacific Ocean is of a character quite distinct from that of the Asiatic and Australian portions, or even of the eastern coastline of New Zealand, resembling more the western coastline of that country, which western coast the Professor makes a boundary of his Southern Ocean. Should the term be adhered to there seems to be some reason for extending the boundary from Stewart Island, New Zealand, to Cape Horn, thus excising an area of a stormy character from the Pacific Ocean. However, the boundaries of the oceans where not fixed by coastlines must be of a more or less arbitrary character, and I can see no sound reason for departing from the divisions and nomenclature recommended by the committee appointed by the Royal Geographical Society in 1845, which consisted of Sir Roderick Murchison, Sir George Back, Captain Beaufort, Sir John Franklin, Mr. Greenough, and Captain Smyth. These gentlemen applied the terms Arctic and Antarctic Oceans to the waters within the corresponding circles, and applied the terms Pacific, Atlantic, and Indian Oceans to the rest of the oceanic waters adopting the meridians of Cape Horn, Cape L'Agulhas, and South Cape, Tasmania, as the division lines where not naturally fixed by the continents. Should the waters within the Arctic and Antarctic circles be considered too small to be termed oceans the former would naturally merge into the Atlantic and the latter into the

the three main oceans whose meridional boundaries would be continued until land is met.

Varying practice exists amongst map-makers as to the limits of Bass Strait, and hence it may be noted that the western boundaries adopted by the Admiralty are from Cape Otway, Victoria, to Cape Wickham, King Island, and thence from the south point of that island (Stokes Point) to Cape Grim, Tasmania. As to the eastern boundary, Admiralty charts and practice seem to vary, in some instances Cape Howe being taken as the northern point, and in others Wilson's Promontory. Personally I would adopt the former. Eddystone Point, Tasmania, is taken as the southern boundary, and the division line may be taken as extending through the islands of Furneaux group.

The celebrated German geographer, Dr. Karl Fricker, has suggested that the channel between Tierra del Fuego and the Falklands on the north, and the South Shetlands and Graham's Land on the south, should be termed Drake Strait in memory of the great British navigator who first sailed in its waters. The proposal does not seem to have attracted the attention it deserves, and is worthy of support. In view of the width of the channel, however, the term "Drake Sea" seems preferable to that of "Drake Strait." Whilst the pioneer exploration of Australian lands is rapidly approaching completion, the scientific examination of our southern seas has scarcely been commenced, and the present is a fitting occasion for bringing the subject under notice. Thanks mainly to the work of the British Admiralty, we have reliable surveys and soundings carried out with considerable detail in the vicinity of our principal ports and in such localities as Wilson's Promontory, and with less detail generally along the coasts, whilst the soundings are sufficiently extensive to fix with reasonable accuracy the position of the Australian continental shelf, which we know passes to the south of Tasmania and is of itself an indication that that island was at one time connected with the mainland. Of deep-sea soundings we have but few, and as a result our information as to the configuration of our ocean beds is very meagre, being based mainly on observations made in connection with the *Challenger* and *Valdivia* expeditions. In view of the enormous areas to be covered those observations were necessarily made at considerable distances apart, and as far as I can gather not a single deep-sea sounding has been made at Australian expense. And yet a detailed working knowledge of our Australian seas would be of immense money value to Australia.

In 1902, before the Victorian Branch of our Australasian Geographical Society, I discussed the effect of variations in the level of the ocean bottom in diverting the ocean currents, and showed that the southern current of Tasman's Sea was derived in this manner from the south equatorial current of the Pacific Ocean. My predecessor in this Chair, Professor Gregory, discussed the subject in his address to the section at Dunedin, pointing out the effect of irregularities in the ocean floor in mixing surface and lower waters with consequent variations of temperatures and densities. In 1898, and again in 1900, I directed the attention of the section to the effect of such variations of temperature

and density of our ocean waters in modifying the nature of our seasons, and this view was subsequently supported very forcibly by Professor Gregory in the address already mentioned and elsewhere. Accurate long-period weather forecasting is a problem of vital importance to Australian graziers, farmers, and others, and its solution would amply justify an expenditure sufficient to defray the cost of the necessary scientific investigation. Both in America and Western Europe it has been proved that an accurate knowledge and continuous observation of the adjoining oceans are essential in such investigations. It is well known that the general track of all weather changes in Southern Australia is from west to east, and hence we are deeply interested in the oceanography of the Indian Ocean to the west and south-west of Australia. With my own limited opportunities I have been able to detect a connection between the variations of the surface temperatures of Bass Strait and the character of the Victorian seasons. Mr. H. C. Russell, then chief of the Sydney Observatory, informed me that he had evidence of an abnormal northing in the westerly winds of the Indian Ocean during the periods over which I had noted high sea temperatures in Bass Strait, causing a drift towards Australia of waters from the warmer parts of that ocean, whilst the low temperatures were coincident with periods in which the southings were more prevalent and the drifts carried greater proportions of the cold Antarctic waters. If such results can be obtained from the comparatively cursory observations made by an individual during his leisure moments, what valuable information may be obtainable from a thoroughly scientific national investigation?

The lines on which such an investigation should be commenced would be as follows:—Soundings sufficiently close to give reliable information as to the general conditions of the ocean floor should be made from 150° E. longitude to 60° E. longitude, and extending from say 50° S. latitude to the coastline or to 20° S. latitude. Preferably the soundings would be carried along meridian lines, say 5° apart, a sounding being taken on each line at each degree of latitude. Whilst at every sounding the temperatures and densities of surface and bottom waters would be observed, at every 5th sounding these should be observed at every 100 or 200 fathoms. The information thus obtained would give a good base, and positions at which closer soundings might be desirable could then be determined. Such a programme would involve 19 lines of soundings averaging about 25 in each, and about 30,000 miles of steaming, irrespective of distances travelled for supplies, etc., whilst, under favourable circumstances, probably eighteen soundings could be taken per week. Allowing for delays the work would probably take about eighteen months, and if carried out with a small steamer might cost about £15,000. In addition, arrangements should be made for all vessels trading to Australia *via* the Cape or the Suez Canal to supply a complete meteorological log to the Commonwealth weather office, giving information relative to the Indian Ocean similar to that supplied by many such vessels to the Meteorological Office in London, whilst our weather office staff should be numerically strong

enough to analyse and digest the information thus obtained promptly and before the conditions to which it applied have passed away. Thus attacked there is a reasonable prospect of the important problem of long-period weather forecasting being solved for Australia.

I am tempted to quote from Professor Gregory's address, already referred to, as follows:—"In meteorology each continent must work out its own salvation. Europe may help us with methods, but we must apply them ourselves to our own waters before we can share in the rewards. Patiently and excellently meteorologists all over Australia are recording the daily changes of our weather; but far out in the great Southern Ocean the fundamental processes that are determining the rainfall a year or two years ahead are passing unnoticed and unknown. Australia has spent vast sums in irrigation works that have failed through lack of water, and provides for accurate records of present weather; but for the sake of a few hundred pounds a year we are leaving unstudied the causes that produce and control it. What gift would be of more benefit to the vast agricultural interests of Australia than a warning as to whether they must be prepared next year to face a drought or a deluge? The apparent fickleness and severity of our climatic changes introduce as large an element of gambling into our farming as there is, alas! in many of our reckless mining ventures. The dragon of uncertainty that now preys on our agriculturists could be defeated by foreknowledge of approaching spells of fair weather and of foul. That knowledge is available if we but seek it. For, like the seer of old, modern science assures us, Cast thy bread on the waters, and thou shalt find it again, though it may be not till after many days."

In conclusion, I wish to quote the able remarks of Lieutenant Pillsbury in connection with his report on the Gulf Stream (U.S. Coast and Geodetic Survey *Report*, 1890, p. 471):—"There is another reason for studying these (oceanic) currents, which will ultimately have the most beneficial influence on mankind. It is now known that the currents vary, through certain forces acting upon them, by periodic changes, entirely according to law, and again through apparently erratic forces. Probably every motion of these vast bodies is absolutely governed by laws which can be ascertained. The moisture and varying temperature of the land depends largely upon the positions of these currents in the ocean, and it is thought that when we know the laws of the latter we will, with the aid of meteorology, be able to say to the farmers hundreds of miles distant from the sea, 'You will have an abnormal amount of rain during next summer,' or 'The winter will be cold and clear': and by these predictions they can plant a crop to suit the circumstances, or provide an unusual amount of food for their stock. We will be able to say to the mariner, at such a time the current will be so much an hour in such a direction, and the percentage of error will be but trifling. From a study of these great forces, then, we derive our greatest benefits, and any amount of well-directed effort to gain a complete mastery of their laws will revert directly to the good of the human race."

Note.—The following is the text of a recommendation adopted by the Council

of the Australasian Association for the Advancement of Science on January 12, 1907 :—

“That the Association urge upon the Commonwealth Government the desirability of undertaking the scientific examination of the Indian Ocean between the meridians of 60° and 150° E. longitude, and from the Australian coastline or latitude 20° S. to latitude 50° S., with the object of obtaining reliable data for long-period weather forecasting.”

BATHYMETRICAL SURVEY OF THE FRESH-WATER LOCHS OF SCOTLAND.¹

Under the Direction of Sir JOHN MURRAY, K.C.B., F.R.S., D.Sc., etc.,
and LAURENCE PULLAR, F.R.S.E.

PART XII.—THE LOCHS OF THE LOCHY BASIN.

THE Lochy basin is a large and important one, having on its boundary-line and within it some of the highest peaks in Scotland, including the highest—Ben Nevis. It stretches from Sgor nan Coireachan on the west to Meall Cruaidh and Creag Ruadh on the east, a distance of over 40 miles, and from Glas Bheinn and Leim Uilleim on the south to Carn Dearg and Carn Leac on the north, a distance of over 20 miles, the total area of the basin exceeding 400 square miles. Within this basin ten lochs were sounded by the Lake Survey staff, viz. Lochs Lochy, Arkaig, Pattack, na h-Earba (east and west), Laggan, Ossian, Gluilbinn, Treig, and an Dubh Lochan. Five of the lochs exceed 3 miles in length, and four exceed 5 miles in length, while one of them (Loch Arkaig) is 12 miles in length; five of them exceed 100 feet in depth, and three exceed 300 feet in depth, while one of them (Loch Lochy) exceeds 500 feet in depth. It has been found convenient to include in this paper also two small lochs which drain directly into Loch Linnhe, viz., Lochan Lùnn dà-Bhrà on the east and Loch nan Gabhar on the west. Loch nan Gabhar is in Argyllshire, while all the remaining lochs are situated in Inverness-shire. Of the lochs and rivers within the area under discussion, Loch Arkaig drains into Loch Lochy by the short river Arkaig, while the other lochs within the basin drain into the river Spean, which joins the river Lochy shortly after its exit from Loch Lochy, the junction of the two rivers being marked by the pretty falls of Mucomir.

The Lochy basin, only a small portion of which has been mapped by the Geological Survey, lies wholly within the region of the crystalline schists of the Central Highlands. It is intersected by the powerful north-east and south-west fault that traverses the Great Glen from Inverness to the shores of Loch Linnhe. In the area west of this dislocation the rocks, so far as known, consist of quartz-biotite granu-

¹ Abbreviated from a paper, with maps and figures, in the *Geographical Journal* for December 1906.

lites and muscovite-biotite schists, which are believed to represent altered sediments. These are traversed by acid and basic intrusions and numerous veins of granite and pegmatite.

East of the Great Glen several of the metamorphic groups of the Eastern Highlands are represented, including the Perthshire quartzite, black schist, limestone, Ardrishaig phyllites, and the associated quartzite, the beds striking generally in a north-east and south-west direction. These schists are pierced by various masses of igneous rock, of which the most important is the large intrusion of granite forming the lower part of Ben Nevis. It is capped by andesitic lavas, breccias, and tuffs, presumably of Lower Old Red Sandstone age.

Loch Lochy.—Loch Lochy is the southernmost of the chain of lochs occupying the Great Glen, which were utilised in forming the Caledonian Canal. Its southern end is about 8 miles north of Fort William. It is a straight loch, running nearly north-east to south-west. In form Loch Lochy is a narrow triangle, with the apex at the north end, gradually widening southward to near Bunarkaig, where the greatest breadth is found, after which it rapidly narrows for the remaining two miles to the outflow at Gairlochy. A good road runs along the eastern shore, a rough cart-road on the western side, and several stations of the Invergarry and Fort Augustus railway now give easy access to the loch on the east side. The surroundings are wild, gloomy, and solitary. No village is found on its shores, an occasional house being passed on the east side, while the west side is uninhabited save for one or two distant cots.

The hills on the west rise with a uniform very steep slope to a height of more than 3000 feet (Sron a Choire Ghairbh), broken only by the deep gashes torn by the torrents in the glacial *débris*, which here extends far up the mountains. On the east the slope is about the same, but the hills less high, the ridge (almost wholly covered with *débris*) which separates Loch Lochy from Glen Gloy reaching to 2000 feet.

The only important streams feeding the loch are the river Arkaig, bearing the superfluent waters from Loch Arkaig, entering near the lower end, and a large burn coming down Glen Gloy, the rest of the feeders being mere mountain torrents. A very small portion of the overflow of Loch Oich enters Loch Lochy by the Caledonian Canal.

The length of the loch is a little under 10 miles, the greatest breadth $1\frac{1}{4}$ miles, opposite the mouth of the Arkaig, and the average breadth three-fifths of a mile. The greatest depth is 531 feet, and the mean depth 229 feet. The loch has a superficial area of nearly 6 square miles, and drains directly an area of about 58 square miles, but as it receives the outflow from Loch Arkaig the total drainage area is nearly 124 square miles. The overflow of Loch Lochy is carried by the river Lochy into Loch Linnhe.

The survey of the loch occupied from April 28 to May 1, 1903; the height of the surface above sea-level on commencing the survey was found to be 94·24 feet, as compared with 93·2 feet observed by the officers of the Ordnance Survey on July 1, 1870. Loch Lochy contains

37,726 millions of cubic feet of water, or nearly 50 per cent. more than Loch Arkaig, the second largest loch in the basin.

At the north end a small basin, called Ceann Loch, measuring one-half by one-third of a mile, and having a maximum depth of 66 feet, is cut off from the main loch by a narrow channel in which the greatest depth is 40 feet.

The main loch is a simple basin, with the U-shaped section characteristic of glacier-formed lakes. All the contours are continuous, those at 50 and 100 feet enclosing areas little less than the total length of the loch. The area enclosed by the 200-feet contour measures $6\frac{1}{2}$ miles in length, by the 300-feet contour $4\frac{3}{4}$ miles, and by the 400-feet contour a little over 3 miles in length. The 500-feet contour encloses a very small area, one-third of a mile long by one-eighth of a mile broad, just about the middle of the loch, and includes the deepest sounding in 531 feet. From opposite the mouth of the river Arkaig to the outflow, the loch shallows rapidly and the contours are irregular.

The flat-bottomed character of the basin is indicated by the comparatively large area covered by water between 400 and 500 feet in depth, an area greater than in the two shallower zones; the zone between 100 and 200 feet, also, is rather larger than the shore zone.

*Temperature Observations.*¹—The surface temperature varied from 43.5° F. to 42.1° . A series taken on April 29 showed the small range from the surface to 425 feet of only 1.2° . The change is very gradual, but quickest in the upper 50 feet, where half of the total range occurs.

Loch Arkaig.—Loch Arkaig is a long, narrow, curved loch, running nearly due east and west, the lower end about one mile west of Loch Lochy and 10 miles north of Fort William.

The lower part of the loch is well wooded, picturesque, and romantic, with hills to north and south, reaching well over 2000 feet in height. The upper part is barer and grander, the mountains exceeding 3000 feet in height. A road runs along the north side of the loch, deteriorating towards the west end into a rough track which leads to Loch Nevis and Loch Morar. Several wooded islands enhance the charm of the scenery, and on one of these is one of the few nesting-places of the osprey, still occupied by the birds at the time the survey was made. There is very good fishing in Loch Arkaig, and lake trout up to 10 lbs. in weight were taken from the loch while the survey was going on.

Loch Arkaig is 12 miles long, of somewhat irregular outline, but broadest in the middle parts and tapering towards each end. The greatest breadth is nearly a mile, the mean breadth half a mile. The

¹ During the past twenty years Sir John Murray has taken many temperature observations in Loch Lochy, and has published and discussed the results in the following papers, to which the reader is referred for further details:—(1) "On the Effects of Winds on the Distribution of Temperature in the Sea- and Fresh-water Lochs of the West of Scotland," *Scottish Geographical Magazine*, vol. iv. p. 345, 1888; (2) "On the Temperature of the Salt- and Fresh-water Lochs of the West of Scotland, at Different Depths and Seasons, during the years 1887 and 1888," *Proceedings Royal Society, Edinburgh*, vol. xviii. p. 139, 1891; (3) "Some Observations on the Temperature of the Water of the Scottish Fresh-water Lochs," *Scottish Geographical Magazine*, vol. xiii. p. 1, 1897.

maximum depth is 359 feet, the mean depth $152\frac{3}{4}$ feet. The surface has an area of $6\frac{1}{4}$ square miles, and the loch drains an area of 66 square miles. The volume of water is estimated at 26,573 millions of cubic feet.

No large loch drains into Loch Arkaig, but several very small lochs do so, the largest being Loch a' Bhlairst, a mile to the north. The chief streams enter at the west end, where a short river brings the drainage of Glens Pean and Dessary, and on the south side, where the stream from Glen Camgharaidh enters near the upper end, and that from Glen Mallie near the lower end. Only mountain torrents enter on the north. The river Arkaig, a mile long, conveys the overflow of Loch Arkaig into Loch Lochy.

When surveyed, in the middle of June 1902, the height above sea-level was found to be 139 feet; the officers of the Ordnance Survey found the elevation to be 139·8 feet above the sea on July 10, 1869.

The basin of Loch Arkaig is nearly simple, the slight irregularities being doubtless correlated with the curving outline. The contours at 50 feet and 100 feet are continuous. A little over two miles from the west end of the loch there is an abrupt narrowing, and the loch continues narrow to the end. Corresponding with this the 200-feet contour is broken into two basins. In the narrow western part is a separate 200-feet basin, with a maximum depth of 262 feet; this is only separated from the main 200-feet basin by a slight shallowing to 183 feet. The main 200-feet basin is about 8 miles long; it includes three areas of over 300 feet, which, however, are only separated by very slight shallowings. The largest of these 300-feet areas is about two miles long, is situated just about the middle of the loch, and includes the maximum depth of 359 feet. The others, further to the east, are close together, and of very slight extent. Though the wide portion of the loch, fully nine miles in length, forms a simple basin, there is not the well-marked U-section found in typical glacier-formed lochs.

Through the kindness of Mr. Thomas Honeyman, factor to Cameron of Lochiel, we have inspected a bathymetrical chart of Loch Arkaig, based upon soundings taken in 1889 by an officer in the German army named Sandler. The chart is drawn to the scale of $1\frac{3}{4}$ inches to the mile, and the soundings are given in fathoms. A comparison of Sandler's map with the Lake Survey map shows that—(1) Sandler's soundings are much less numerous than those taken by the Lake Survey, and many of his lines were taken in zigzag fashion instead of running at right angles to the axis of the loch; (2) Though there is a general agreement between the two maps, the Lake Survey map shows as a rule rather deeper water, position for position; for instance, taking the deepest soundings on each of Sandler's lines, and placing it approximately on the Lake Survey map, deeper soundings occur in the vicinity; thus Sandler's deepest sounding in 55 fathoms (330 feet) approximates to the Lake Survey maximum in 359 feet.

Temperature Observations.—The surface temperature in the centre of the loch varied from $48\cdot3^{\circ}$ F. to $51\cdot5^{\circ}$ during the three days of the survey; near shore it reached $52\cdot3^{\circ}$ on June 13. A series taken in the

main basin on June 11 showed a range of 4.7° from the surface to 280 feet, the greatest variation being observed in the superficial layers of water.

Loch Pattack.—Loch Pattack (or Pattaig) lies at a considerable elevation among the mountains which separate Loch Ericht from Loch Laggan. It is only about two miles distant from Loch Ericht, though it belongs to a different drainage system, draining by the river Pattack, some nine miles long, into the upper end of Loch Laggan. It is a loch of somewhat irregular form, about a mile long by half a mile broad, its long axis running nearly north-east and south-west. The maximum depth is 58 feet, and the mean depth 14 feet. The volume of water is estimated at 106 million cubic feet. The superficial area is about 173 acres, or fully a quarter of a square mile, and it drains an area of 18 square miles. It receives the greater part of the drainage of the east side of the mountain mass, of which Ben Alder (3757 feet) is the highest peak. In this drainage area are three smaller lochs, which were not surveyed. When surveyed in May 1904, the height above sea-level was estimated (from spot-levels) at 1419 feet.

The basin is quite simple, the contours roughly following the irregular outline of the shore, and the deepest part almost in the centre of the loch. The slopes are gentle, except opposite the mouths of the two rivers, both of which have laid down alluvial promontories, with small islands, from which the incline to the deepest water is rapid. The loch is on the whole shallow, for 78 per cent. of the lake-floor is covered by less than 20 feet of water, and 60 per cent. by less than 10 feet of water.

Temperature Observations.—A series of temperatures, taken in the deepest part of the loch, gave 42.6° F. at the surface, 41.4° at 25 feet, and 40.8° at 50 feet.

Lochan na h-Earba.—The two lochs which bear this name may have formed at no very distant date a single loch, as suggested by the common name and by the appearance of the ground. Be that as it may, they are now two distinct lochs, differing by nearly 10 feet in level. In April 1873, the Ordnance Survey officers found the elevation of the west loch to be 1151.7 feet, and that of the east loch 1142.3 feet, above sea-level. They lie in a valley, which runs nearly parallel to that occupied by Loch Laggan, to the south side of that loch, and distant from it about a mile. Hills of over 3000 feet rise close on the east; on the west they are separated from Loch Laggan by a ridge of between 2000 and 2500 feet in height. The shores are for the most part wooded.

The West Loch.—This is the larger, broader, and deeper of the two. It lies at an elevation of about 1150 feet, some 330 feet higher than Loch Laggan. It is fully $1\frac{3}{4}$ miles in length, rather less than one-third of a mile in greatest breadth, and a quarter of a mile in mean breadth. The greatest depth is 81 feet, the mean depth over $35\frac{1}{2}$ feet. It has a superficial area of about 263 acres, or less than half a square mile, and drains an area of fully 5 square miles. The volume of water amounts to 408 millions of cubic feet. The loch is fed chiefly by two small streams, coming down from Beinn a' Chlachair, which unite just before entering

the loch. A stream, half a mile long, winds through a boggy flat, conveying the overflow to the east loch. The long narrow loch is nearly straight. From the centre it narrows to the outflow, but south-westward to the upper end the width is nearly uniform, the end rectangular, straight, and a quarter of a mile across.

The basin is quite simple, none of the contour lines being broken. The contours do not closely follow the shore-line; they narrow more decidedly than the outline from the centre to each end, the slopes being much steeper towards the centre of the loch, where the sections are U-shaped. The deepest part is rather to the east of the centre, and it is curious to note in close proximity an elevation with only 30 feet on it, surrounded on all sides by water exceeding 50 feet in depth.

Temperature Observations.—A series of temperatures at the deepest part of the loch showed a range 4.8° F. from top to bottom. The greater part of this was in the upper 10 feet, the difference between 10 and 60 feet being only 1° .

Near shore the surface temperature was as high as 53.4° , the air temperature being 62.2° .

The East Loch.—This is about half a mile distant from the west loch, and nearly 10 feet lower, about 1140 feet above the sea. It is $1\frac{1}{4}$ miles long, a quarter of a mile in greatest breadth, and averages just under one-fifth of a mile in breadth. The maximum depth is 69 feet, and the mean depth 31 feet. It has an area of about 146 acres, or nearly a quarter of a square mile, and drains an area extending to about $9\frac{1}{2}$ square miles, including that draining into the west loch. The volume of water is 191 millions of cubic feet, or less than half the volume of the west loch. The chief feeder is the stream from the west loch. There enters also at the upper end a branch of the Allt na Magha, the stream which has laid down the delta now separating the two lochs. About the middle of the east shore enters the small stream coming from Loch an Iubhair. The waters of Lochan na h-Earba are discharged by the Allt Lowrag, about a mile long, into Loch Laggan.

The east loch has the same general form as the west loch, long and narrow, broader at the upper end and tapering to the outflow. The deep water is all towards the upper end, the lower half of the loch being very shallow. The area enclosed by the 50-foot contour is about half the total length of the loch, and in this part the sections are somewhat U-shaped. A slight shoaling is observable opposite the entrance of the stream near the middle of the eastern shore, where, in the centre, the deepest sounding was 52 feet, with depths of 60 feet and over both to the north-east and south-west.

Temperature Observations.—Serial temperatures in the deepest part indicated practically the same range (5°) as in the west loch, and the distribution of temperature was exactly similar, but all parts of the loch were about 1° higher.

Loch Laggan.—Loch Laggan is situated in the southern portion of Inverness-shire, between the Highland and West Highland railways, being about equally distant from the nearest points of each. Dalwhinnie, on the Highland Railway, is about $6\frac{1}{2}$ miles from the upper

end of the loch; Tulloch, on the West Highland Railway, is about six miles from the lower end. The coach road from Kingussie to Tulloch passes along the northern shore. The loch runs nearly north-east and south-west, and occupies a valley lying between the very high mountains of Badenoch on the south-east and an equally high and more extensive mountain mass of the district of Lochaber on the west. The loch is of the usual elongate narrow form of Scottish lochs, narrowest in the central parts, and somewhat expanded towards each end, where deeper water occurs. The outline is very irregular, and the bottom, as shown by the contours, correspondingly irregular. A number of larger and smaller islands are found in the narrower parts of the loch. The length is a little over 7 miles, the greatest breadth two-thirds of a mile, the mean breadth nearly half a mile, the superficial area about 1900 acres, or nearly 3 square miles. The maximum depth is 174 feet, the mean depth 68 feet, and the volume of water about 5600 millions of cubic feet. The loch was surveyed on June 2 and 3, 1902, when the elevation of the lake-surface above the sea was found by levelling from bench-marks to be 818·6 feet; the officers of the Ordnance Survey found the elevation to be 818·9 feet above sea-level on October 19, 1867. The shores are wooded nearly throughout, and the scenery wild and picturesque, the mountains rising abruptly on the north side into a series of peaks, culminating in Creag Meaghaidh, 3700 feet high. On the south-east the high mountains are more distant, Beinn a' Chlachair, over 3500 feet, being 4 miles from the lower end of the loch. Close to the loch on this side, two hills, rather more than 2000 feet in height, separate it from the valley in which lies Lochan na h-Earba. Loch Laggan drains directly an area of 34 square miles, but since it receives the overflow from Loch Pattack and Lochan na h-Earba, its total drainage area is nearly 62 square miles. The principal stream entering the loch is the river Pattack, which drains Loch Pattack and a number of smaller lochs. The Allt Lowrag brings the overflow of Lochan na h-Earba. Near Aberarder, in the middle of the north shore, two large burns enter, and there are many smaller streams on this side. The river Spean issues from the loch, and flows into the Lochy close to Loch Lochy.

Contours are drawn for every 25 feet of depth. The bottom is so irregular that only the 25-feet and the 50-feet contours are continuous, and follow approximately the outline of the shore. All the others are much broken up. The 75-feet contour is broken into four distinct portions; the largest of these approaches the west end of the loch, and is $2\frac{1}{2}$ miles in length. Two lesser areas, each about two-thirds of a mile in length, occur close together in the narrow middle part of the loch. The 75-feet area towards the upper end of the loch is nearly $1\frac{1}{2}$ miles in length. The shallows between these various basins are all opposite the mouths of streams, but in one instance the stream is too small to account for the shallowing, and other larger streams appear to have had no effect on the contours. The largest 75-feet basin includes two areas of over 100 feet, a very limited one in the narrow part of the loch, with a maximum depth of 105 feet, and another, $1\frac{1}{2}$ miles in length, near the west end. This 100-feet area is at the broadest and deepest part of the

lake, and includes an area, two-thirds of a mile in length, of over 150 feet, in which two soundings of 174 feet and 170 feet respectively were taken, with a shallowing of 155 feet between them. The two small 75-foot areas near the middle of the lake include depths of 112 and 114 feet respectively. The easternmost 75-foot area includes two very small basins of over 125 feet, with maxima of 133 and 141 feet. Many lesser irregularities occur. For about half a mile from the inflow of the river Pattack the loch is very shallow, and the bottom and shores are sandy.

Temperature Observations.—A series of temperatures, taken towards the east end of the loch at noon on June 3, 1902, indicates a range of only 1.2°F ., the greater part of the variation occurring in the upper 10 feet of water.

Loch Ossian.—Loch Ossian (or Ouchan) is a narrow loch in a valley running nearly north-east and south-west to the north of Rannoch moor. It lies at a considerable elevation, about a mile north-east of the summit of the West Highland Railway, at Corroul Station, from which the loch can be seen. The mountains rise to over 3000 feet both on the north-west and south-east. The former solitude is now relieved, since the mansion of Sir John Stirling-Maxwell, Bart., has been built on the shore of the loch.

In form Loch Ossian is narrow, with its long axis slightly curved, and of nearly uniform breadth throughout. It is $3\frac{1}{4}$ miles long, nearly half a mile in greatest breadth, and has a mean breadth of about one third of a mile. The greatest depth is 132 feet, and the mean depth 43 feet. It has a superficial area of just about a square mile, and a volume of 1224 millions of cubic feet. It drains an area of nearly $10\frac{1}{2}$ square miles, receiving only mountain torrents from the surrounding hills, and flows out by the river Ossian into Loch Ghuilbinn, $2\frac{1}{2}$ miles to the north. The loch was surveyed on May 14, 15, and 16, 1902, when the height of the water above sea-level was found to be 1268.7 feet; this is nearly identical with the level determined by the Ordnance Survey officers on May 27, 1870, viz. 1268.6 feet.

The bottom of Loch Ossian is very uneven, the transverse, as well as longitudinal, sections being undulate. Only the 25-foot contour follows the line of the shore. The 50-foot contour encloses an area two miles in length. The south-western portion of this for three-quarters of a mile is exceedingly narrow. Near the middle of the loch it broadens to a quarter of a mile, and continues broad to near the outflow. The area over 75 feet in depth is fully a mile in length, that over 100 feet half a mile, and that over 125 feet a quarter of a mile in length. One mile from the upper end there is in the centre of the loch a shoal, over which the depth is only 11 feet.

The area of the lake-floor covered by water between 25 and 50 feet in depth is larger than the shore-zone covered by less than 25 feet of water.

Temperature Observations.—A series of temperatures taken at 1 P.M. on May 16, 1902, shows a range of less than 1°F .

Loch Ghuilbinn.—Loch Ghuilbinn (or Gulbin) is a small and relatively broad loch, lying in the midst of the high mountainous region between Lochs Ericht, Treig, and Laggan. The long axis runs nearly north and south. The surrounding hills rise on all sides into peaks of well over 3000 feet. The loch is fully three-quarters of a mile long, and nearly half a mile in greatest breadth, with a mean breadth of a little over a quarter of a mile. The greatest depth is 49 feet, and the mean depth over 13 feet. The superficial area is about 146 acres, or nearly a quarter of a square mile, and the volume 85 million cubic feet. It receives the drainage of a basin extending to 29 square miles, including Loch Ossian. It is fed chiefly by the river Ossian, which, besides bringing the overflow of Loch Ossian, receives the drainage of considerable glens both to the east and west. Its outflow is by the river Ghuilbinn, which flows due north about five miles and enters the river Spean just below Loch Laggan. The level of the loch is estimated from spot-levels on the shore to be 1160 feet above the sea.

Loch Ghuilbinn is a simple basin. The sides slope very gently down to 20 feet, nearly 86 per cent. of the whole area of the loch being less than 20 feet in depth. From 20 to 40 feet the slope of the sides is much steeper. A very small area exceeds 40 feet in depth, only about $3\frac{1}{2}$ per cent. of the whole. The surface temperature on May 17, 1902, varied from $45\cdot0^{\circ}$ to $45\cdot3^{\circ}$ F.

Loch Treig.—Loch Treig occupies a deep narrow valley among very high mountains in the region of Lochabar. The valley trends nearly due north and south. The West Highland Railway runs along the east side, and Tulloch Station, whence the coach road goes off towards Kingussie, is only two miles from the north or lower end of the loch. There is no road on either side of the loch, nor is there to the south any public road nearer than Kingshouse, at the head of Glencoe, Rannoch Station being about equally distant. The old road from Struan to the old Corrou Lodge came to the head of the loch, but is now disused and in bad condition. A cart-road approaches the north end of the loch. The sides of the loch are quite uninhabited, but at or near either end are a few keepers' houses and farms. The mountains rise very steeply on either side, those on the west being higher, rising in a series of peaks, the highest of which (Stob Choire an Easain Mhoir) reaches a height of 3658 feet; on the east the highest peak is Cnoc Dearg, 3433 feet high.

The length is a little over five miles, the greatest breadth three-quarters of a mile, mean breadth just under half a mile. The maximum depth is 436 feet, the mean depth 207 feet. The area of the loch is nearly $2\frac{1}{2}$ square miles, and it drains an area of about 42 square miles. Three streams, considerable only during floods, enter the upper end of the loch; the sides are unbroken by any large stream, but are scored by the torrents which cut through the glacial *débris*, which here, as at Loch Lochy, extends far up the hillsides. The overflow is carried by the short river Treig into the river Spean at Tulloch. On May 29, 1902, when the survey was finished, Loch Treig was 787·0 feet above

sea-level; the level was high in consequence of recent rains. On July 13, 1886, the Ordnance Survey found the height above the sea to be 783·9 feet. In volume Loch Treig comes third among the lochs of the Lochy basin, containing 13,907 millions of cubic feet. This is more than twice the volume of Loch Laggan, rather more than half that of Loch Arkaig, and one-third that of Loch Lochy.

In form Loch Treig is a narrow triangle, broadest towards the south end, and tapering all the way to the outflow. Half a mile from the north end a rocky promontory, the Rudha Ceann Ard Thonnaich, constricts the loch, but there is no shallowing in the narrows, where the depth is well over 200 feet. The basin is quite simple, all the contours approximately following the shore-line. The steep slope of the hills is continued under water, and there is in most parts but little beach. The axis of the loch is slightly curved, and the line of greatest depth is nearer the west shore. The area over 400 feet deep is very narrow, about two miles in length, and at both ends comes very close to the west side, the steepest slopes in the loch being at these points. The cross-sections in the middle parts of the loch only show slightly the U-shape which distinguishes glacier-hollowed lochs. The valley is so narrow, relatively to the depth of the loch, that the steep slopes reach far towards the middle, and leave but little comparatively level bottom. Towards the south end, where the loch is broader, and the depth less (from 200 to a little over 300 feet), there is a greater extent of nearly flat bottom, and the U-section is more clearly marked.

Temperature Observations.—At the early season when Loch Treig was surveyed, the surface was very little warmer than the bottom, the whole difference between the surface and 300 feet, on May 29 when the last series was taken, being only 1·7°. Four days earlier, May 24, the difference was only 0·7° F. In the interval the surface had risen in temperature 1·6°, while at 300 feet the rise was only 0·6°.

An Dubh Lochan.—A very small loch situated about half way between Loch Treig and the river Spean and a little to the west of the river Treig. It lies at an elevation of 785 to 790 feet above the sea, at the west side of an extensive deposit of gravel and sand, hills of moderate height rising on the west shore. It is of somewhat oblong form, diversified by many little bays, and is shallow and weedy towards the south end. It is nearly a quarter of a mile long, and covers an area of about 8½ acres. The greatest depth is 40 feet, and the mean depth 15½ feet. The volume of water amounts to 6 millions of cubic feet. It has a drainage area of about one-sixth of a square mile, receiving only local superficial water. It drains by a small stream northward into the river Spean.

The basin of the loch is quite simple, the deepest part being much nearer the north end, and the longitudinal slope is accordingly quicker at the north end and very gradual towards the south. The temperature of the water on October 18, 1904, was 46·0° F. at the surface, the same at a depth of 20 feet, and only a trifling fraction less at the bottom, 45·8°.

Lochan Lùnn dà-Bhrà.—A very picturesque loch, almost half way between Fort William and Ballachulish. It is about five miles south of Fort William, and is reached by a very rough road, one of General Wade's military roads. It is a narrow loch, with its axis running north-east and south-west. The surrounding hills are of moderate height (1500 to 2000 feet) and grassy, except on the east, where Mullach nan Coirean rises steeply to 3000 feet. Patches of fir wood towards the lower end of the loch enhance the beauty of the scene.

The loch is nearly a mile long and relatively very narrow, the greatest breadth being only about one-sixth of a mile, and the mean breadth one-eighth of a mile. The maximum depth is 25 feet, and the mean depth $8\frac{1}{2}$ feet. The surface has an area of about 66 acres. The volume of water is 23 millions of cubic feet. It receives the drainage from an area of over a square mile, by small burns only, and flows out by the Water of Kiachnish into Loch Linnhe.

At the date when surveyed (May 9, 1903) the height above sea-level was 510·1 feet, exactly one foot lower than the elevation determined by the Ordnance Survey officers in May, 1867.

The basin of Lochan Lùnn dà-Bhrà is broken by islands, about a quarter of a mile from each end, and nearly in the middle of the loch. The island towards the upper end is on a bar, the greatest depth to the north-west and south-east of it being respectively 9 and 8 feet. This bar cuts off a separate small basin, with a maximum depth of 21 feet. The greatest depth of the loch, 25 feet, was found not far to the north-east of this island. North-east from the lower island it is everywhere shallow, nowhere exceeding 7 feet.

The shores of Lochan Lùnn dà-Bhrà are composed chiefly of gravel with boulders, which form many heather-covered mounds. Rock is exposed in many small spots. The stream flows out through a flattish tract, covered with moraine mounds, about half a mile long, and rock was seen in the channel at a distance of about 100 feet from the loch. The promontory below Lundavra farm has been laid down by the stream.

We were told by the local inhabitants that the loch will sometimes freeze all over in a single night, and that small dark trout are abundant in it. There are also some pink-coloured trout, and others silvery like salmon.

The temperature was 48·0° F. throughout.

Loch nan Gabhar.—Loch nan Gabhar (or Gour) is a little weedy hollow lying close to the sea-shore, and very little above sea-level, on the west side of Loch Linnhe, nearly opposite Ballachulish. It runs nearly east and west, and occupies the southern portion of a large oval alluvial flat, in the midst of which rises an abrupt boss of rock, the Tòrr an Duin, apparently some 70 or 80 feet in height. This alluvial flat is surrounded by steep rocky hills, which form the southern shore of the loch.

The loch is of very irregular form, and interrupted by narrows, bays, and promontories. It is fully half a mile long, one-sixth of a mile

in greatest breadth, and one-eighth of a mile in mean breadth. The maximum depth is 5 feet, and the mean depth $2\frac{1}{2}$ feet. The area of the water-surface is only about 45 acres, and it receives the drainage of 13 square miles of country. The height above sea-level, on the date when the survey was made (May 12, 1903), was 7.35 feet, as compared with 7.5 feet observed by the officers of the Ordnance Survey on July 19, 1867.

Loch nan Gabhar receives by the river Gour the drainage of a considerable mountainous stretch of country, bordering Glen Gour, which extends five miles west from the loch, among peaks rising to nearly 2500 feet. Two branch glens extend several miles to the north, and one of these brings the overflow of a small loch, Lochan na Beinne Baine, which was not surveyed. As a consequence of the extensive drainage area, the loch is subject to great alterations of level. The river has laid down long spits of sand, and threatens to silt up the loch altogether. A very short stream conveys the overflow to the sea; there is a boss of rock on the north side where it leaves the loch. In volume Loch nan Gabhar is the last in the basin, containing only five millions of cubic feet, or one million less than the volume of an Dubh Lochan.

The temperature of the water on May 12, 1903, was 51.5° F. at the surface and at the depth of five feet.

The Red Lochan at Tulloch.—The Red Lochan, called in Gaelic by a name which signifies "brown eye," is a very small pond lying in an extensive morainic terrace at Fersit, near the north end of Loch Treig. It is only about 30 yards in its longest diameter, and 5 feet deep in the centre, is fed only by rains, and has no outflow except by percolation through the gravel, yet its surface is maintained almost constantly at the same level. The water is always turbid, and varies in colour from dull green to brown or red.

It was first examined by Sir John Murray in May 1902. The water was then brown; the collection taken with the coarse net very pale yellow, that taken with the fine net a decided red. At that time there were only two very abundant organisms—the larva of an insect, *Corethra*, known as the "phantom larva," and a reddish-coloured rotifer, *Anuraea valga*. There were many other rotifera, entomostraca, and other organisms common in ponds, but none of these were abundant enough to be held responsible for the colour of the water. The collection made with the fine net was examined by Dr. T. N. Johnston and James Murray. On adding a little formalin, which killed the animals, a blood-red sediment was deposited, which was found to consist chiefly of *A. valga* and myriads of its red eggs. At that time this species seemed to be mainly the cause of the red colour.

Examined at different seasons, the colour was found to vary. In October 1903, it was very red; in May 1904, dull brown; in January 1905, green. On all these occasions the phantom larva was about equally abundant, and none was seen in a more advanced stage of development. The changes of colour are doubtless correlated with the predominance of one or another organism. The *A. valga* is not always red; in May

1903, it was dull grey in colour. When algæ are swarming, the colour will incline to green. The colour may be affected by the development of certain entomostraca — *Diaptomus gracilis*, for instance, was very abundant, but quite colourless, in May 1903. Later in the year it becomes brown or red.

There are other ponds in close proximity to the Red Lochan, but none of these shares the turbidity and reddish-brown colour. The peculiarity is probably due to its being more closely shut in. The surrounding rim of gravel is 14 feet above the pond at its lowest part. There is, besides, a fringe of birch trees. The water is stagnant, which favours the growth of certain organisms, particularly *Anuraea valga*. The blood-red larva of *Chironomus*, though abundant, could have no part in causing the red colour, as it was not in the open water, but among the weeds and mud.

Mr. Robertson, the keeper at Fersit, to whom we are indebted for several collections and much information about the loch, states that it is later in freezing than the other ponds in the region. The more active decomposition in the stagnant water would account for this.

The temperature of the water in May is about 45·0° F. It is said that wildfowl never settle on this pond, and that the common frog cannot live in it.

The following legend was related to Sir John Murray concerning this Red loch :—

“Many centuries ago there lived in these parts a noted hunter named Donnuil. In return for some services rendered to the witch of Ben-a-Vreich, she offered to deprive the deer either of the sense of sight or of smell, so far as he was personally concerned. He chose to have the deer deprived of the sense of smell, ‘for,’ said he, ‘I can easily cheat their eye.’ The witch, however, told him that in the stomach of the last stag he would kill there would be found a ball of worsted thread. As time passed Donnuil became ill, and, while weak in bed, his daughter told him a fine stag was caught by the horns in some bushes near the house. He asked for his cross-bow, and, although in bed, he shot the stag through his bedroom window. Later on his daughter brought him a ball of worsted which had been found in the stomach of the stag. He knew his end was near; indeed, he died the same evening. On the following morning the Red Lochan had appeared at the place where the stag was killed.”

This story was evidently invented to explain the origin of the Red loch, and is of the same order as those stories invented to explain why the fox has a bushy tail, and why the serpent crawls on his belly.

NOTES ON THE BIOLOGY OF THE LOCHS IN THE LOCHY DISTRICT.

By JAMES MURRAY.

THERE is little peculiarity in the biology of the large lakes in the basin, except in that of Loch Lochy. They contain the ordinary fauna of great lakes of low tem-

perature. Most of them were surveyed so early in the season that the water was little above the minimum winter temperature, and the summer crustacea (*Holopedium*, *Leptodora*, etc.) had not arrived. The smaller lochs were warmer, and some of those crustacea were present.

Loch Arkaig.—The plankton is almost exactly that typical of large lakes, with hardly any local peculiarity. The larva of *Leptodora*, which we have rarely found, was present. A few examples of the somewhat rare *Latona setifera* were found. A few species of plankton-desmids, chiefly of the genus *Staurastrum*, occurred, but they were less conspicuous than in the lochs farther west.

Loch Lochy.—Though the situation of Loch Lochy is so similar to that of Loch Ness, and though the depth in the two lochs is comparable, the plankton of Loch Lochy offers a remarkable contrast to that of Loch Ness. In two different years when the lochs were examined, the plankton in Loch Lochy was found to be much richer. The quantity was many times greater, the species more numerous, but the special feature was the quantity and variety of the phytoplankton. This will be treated in detail later by Prof. Bachmann. Diatoms were very abundant. *Tabellaria fenestrata*, var. *asterionelloides*, was of more luxuriant growth than had been observed elsewhere, the colonies often making more than two complete turns of the spiral. The rare crustacean *Ophryoxus gracilis* (discovered in Britain in Loch Ness by Mr. D. J. Scourfield) was present. The heliozoon *Clathrulina*, of frequent occurrence in our larger lakes, but usually as skeletons merely, was here abundant and alive, the majority of the examples having the pseudopodia fully extended.

Lochan na h-Earba.—The fauna calls for little comment. *Latona setifera* was found in the west loch. Of the summer crustacea, *Holopedium* was in both lochs, *Leptodora* only in the east loch, and *Diaphanosoma brachyurum* only in the west loch. Desmids were conspicuous in both lochs, and included some species which we have not often found.

Loch Laggan.—The plankton is quite ordinary, except that it is the only loch of the basin where we observed two species of *Diaptomus*. One was the common *D. gracilis*, the other difficult to determine, owing to the lack of fully matured examples, but almost certainly *D. laticeps*.

Loch Ossian and Loch Ghuilbinn.—The fauna of these lochs is in no way peculiar. Desmids were scarce in Loch Ossian, and abundant in Loch Ghuilbinn, where, among others, *Staurastrum ophiura* occurred.

Loch Treig.—*Bosmina obtusirostris* had a very long spine, approaching the variety *longispina*, as found in Loch Morar. This is the only large lake where we found the rotifer *Triarthra longiseta*. Skeletons of *Clathrulina* were abundant. The phytoplankton was fairly rich in species, and about a dozen Desmids were noted.

An Dubh Lochan.—This was examined very late in the season. The chief peculiarity noted was the red colour of the *Diaptomus*, a feature found in more marked degree in Lochan Lùnn dà-Bhrà. Desmids were abundant, and the two fine species, *Staurastrum braziliense* and *S. longispinum* occurred.

Lochan Lùnn dà-Bhrà.—The *Diaptomus* in this loch was so deep red that when the nets were taken out after towing they seemed to contain blood.

Loch nan Gabhar.—From its shallow weedy character an abundant fauna would be expected here, yet we found the collections exceptionally poor.

CORRECTION.—*King Eider Duck*.

In our paper on the "Lochs of the Tay Basin," Part III., which appeared in the *Scottish Geographical Magazine* for January 1904 (vol. xx. p. 15), the following

sentence occurs: "The king eider is said to have bred in the White Loch for some years, and to have successfully reared its young." This is evidently an error, and I am sorry the sentence should have escaped my notice in reading the proof of the paper. The statement was entered in the note-book of one of the assistants of the Survey on the authority of one of the neighbouring proprietors of the district familiar with the ornithology of the White Loch. I am not able to state what bird was taken for the king eider.—JOHN MURRAY.

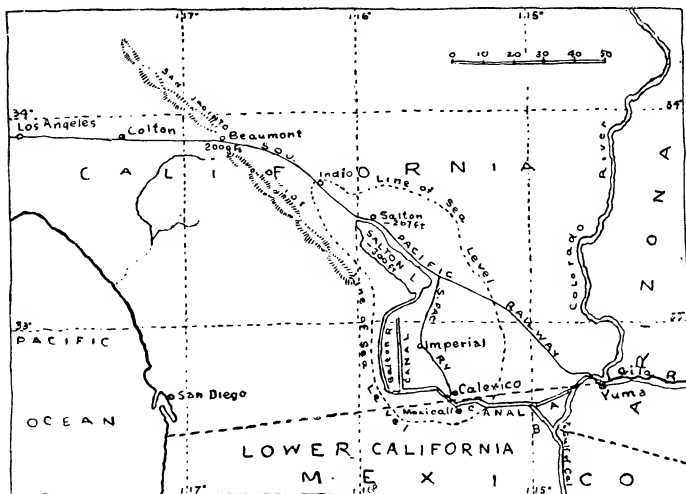
THE VAGARIES OF THE COLORADO RIVER.

By JACQUES W. REDWAY, F.R.G.S.

(With Map.)

ABOUT fourteen years ago I described, in the columns of the *Geographical Journal*, the conditions which caused the Colorado River to overflow its banks, desert its lower course, and flow temporarily into the Colorado desert. At that time the overflow lasted a few weeks only, and, for reasons that I shall endeavour to make plain, the river soon recovered its former channel. Within the past few months the river has again turned its flood into the desert, with results that have proved tremendously destructive, and have at the same time brought about international complications.

Long ago, but probably within the limit of quaternary times, the Gulf of California extended much further northward than it does at the pre-



sent time. It certainly included the region shown on the accompanying map¹ within the contour of sea-level; it probably included nearly another

¹ This map is only approximately correct.

two hundred miles of Salton Lake, bearing the ominous name—Death Valley. The area within the contour of sea-level has borne several names. As I first knew the region it was called both “Coahuilla” and “Conchilla” Valley; it is now commonly known as Imperial Valley. The flooded portion, since the flood of 1892, has been known as “Salton Lake”; in my time it was known as the “Sink of San Felipe,” from the fact that an occasional cloudburst on the eastern slope of the San Jacinto ranges sent a flood of water into the lower part of the basin. The entire region east of the San Jacinto divide is a most pronounced desert, whose summer temperature is comparable with that of the region about the Red Sea. For two weeks at a time I have seen the thermometer vary from 100° to 124° in the shade: in the midday sun it ranged from 140° to 145° .

An inspection of the accompanying map shows that the Colorado River flows practically around the side of a hill—that is, the land to the westward is much lower than that to the eastward; so whenever the river is running more than bank full, it flows out into the desert to the westward. This has happened many times, and many dry “washes” and sinks mark the various overflows. Several of these channels are wide and deep. One of them, New River, has found a place on most maps. It is generally represented as a stream rising in the San Jacinto mountains and flowing into the Colorado; as a matter of fact, however, it flows out of the Colorado into the hollow of the former head of the Gulf of California. The Colorado itself has probably flowed into the Gulf in about the same place in which it now flows ever since it has existed. It is one of the muddiest rivers in the world, and, in time, the enormous loads of sediment brought from the Sierra Abajo plateau have bridged the gulf, leaving a depression of 300 feet below sea-level to the north-west. Steadily-blowing winds, sometimes from one direction, sometimes from another, have wrought great changes in the topography, and have brought thither the seeds of many species of plants. The excessive growth of the latter, after the flood of 1892, directed the attention of ranchers to the fact that water alone was needed to make the region wonderfully productive. If weeds, why not foodstuffs?

So the ranchers began taking up lands that could be irrigated, and, in time, several hundred small farms were yielding crops that in both quality and quantity almost staggered belief—grain, grasses, fruits and vegetables; in a few years a fifty-acre ranch would make its owner rich. Moreover, the surveys showed that, at a conservative estimate, nearly twelve thousand square miles of desert land might be reclaimed. The California Development Company was therefore organised for the purpose of supplying the required water, and in the fall of 1900 began an elaborate system of canals, the main trunk of which is shown on the map. In July 1901 water was supplied to about two square miles of cultivated lands; in five years from that date the demands for irrigation water came from the owners of 225,000 acres—about 350 square miles of cultivated fields. By this time, moreover, the rapidly increasing population of farmers had become clamorous for more water.

The canal was constructed (see A on the map) along the dry wash

of Salton River, a distributary of the Colorado, formed in the same manner as New River. At low water on one of the succeeding years the out-take became clogged with silt² on account of the reduced velocity of the river. Two other out-takes were dug with the same result. All these were in the State of California and, therefore, within American territory.

The third attempt was made just across the international boundary (see B on the map), at a place where, it was thought, the grade was steep enough to carry the thick river sediments. It was. From the moment the water was turned into the canal it was practically beyond control. What was worse, the contractors had failed to put in headgates. But inasmuch as the Colorado was at low-water, no great damage resulted. The engineers reckoned on having several months in which the headgates might be constructed, but they did not take the Gila River into their plans. Now, the Gila is a most uncertain factor; in the space of twenty-four hours it can roll down a tremendous torrent of water. And this it proceeded to do. Cloudbursts in the Mogollon plateau and its outlying ranges poured a flood into its channel and the wall of water passed Yuma. It made short work of the place where the headgates of the canal should have been, but were not.

By the time the engineers had obtained the material for setting the headgates, the annual flood of the Colorado was also on hand. The canal originally was about fifty feet. As I saw it in the month of January it was not far from a mile in width. The town of Calxico had narrowly escaped destruction. On the opposite side of the canal, in Mexico, the village of Mexicali had grown into existence. The swiftly moving flood made short work of it, however, and in a few hours only a few scattered dwellings were left. The flood also filled the channel of New River, cutting it out in one place, and forming a lake several square miles in extent. New River itself was half a mile wide.

In the meantime the Southern Pacific Railway had taken the matter in hand, in order to save about a hundred miles of road bed. A temporary track was built to the break, and the work of closing the breach was put in the charge of Colonel Randolph, an expert in work of the kind. Under his supervision a dam, or wall of stone and mattresses held in place by driven piles, was immediately begun, and by early fall the river had been turned back into its former channel. The dam itself was built in a skilful manner, but availed little. A December flood in the Colorado made a breach elsewhere and the river again poured its flood into Imperial Valley.

In January of the past year I rode nearly fifty miles along the shore of a lake whose dry basin years before I had traversed half a dozen times. It was then the most inhospitable desert I have ever seen. Nearly fifty years ago Dr. J. P. Widney, an army surgeon, first called public attention to the possibility of flooding it. General Stoneman, after-

¹ The carrying power of flowing water increases enormously with the rate of the velocity of flow; if the velocity be doubled, the water will carry sixty-four times as much sediment, and conversely.

ward Governor of California, threw cold water on the project in the form of a demonstration that the whole volume of the Colorado would not fill the depression, so great is the rate of evaporation. I am inclined to think that General Stoneman's position is correct; the intrusion of water would obliterate about every effort that has been put forth in the way of reclamation, however.

On the supposition that the flow of the river should continue, there would certainly be a lake much larger than Salton Lake is at present. Moreover, the lake would be much larger in winter than in summer, when the rate of evaporation is enormous. From a physiographic standpoint the question is not difficult. Left to itself, the flow will continue until the silting of the new channel raises the latter to a level higher than the old bed. The first process in this direction is already visible. From a point near Calexico, where the grade is steepest, the "backcutting" has been very rapid; as nearly as I could judge, it has been a quarter of a mile or more a day. The recession, of course, will be slower in the future, but it will be felt above Yuma. The immediate tendency will be to bring the channels of the canal wash-out and the river nearer to the same base level. Ultimately the river, wandering alternately from the one channel to the other, will fill Imperial Valley with sediments. What the river fails to do the wind will accomplish. Any work that man may undertake will be ephemeral.

Some tempest-in-a-teapot international complications are likely to arise. The Colorado is a navigable stream; its mouth is in Mexico. An American corporation has crossed the international boundary and, operating in Mexican territory, has diverted the navigable waters of the river into the territory of the United States. Cannot the sovereign State of Mexico demand either that the water be restored to the former channel, or else that a measured portion of it be diverted into Mexican territory for purposes of agriculture? Justice certainly demands one or the other.

THE VEGETATION OF WESTERN AUSTRALIA: A REVIEW.¹

THE memoirs which together constitute *Die Vegetation der Erde* stand prominent as models of description of vegetation on geographical lines. Their wide method of treatment renders them quite as important to the geographer as to the botanist. Each memoir covers a large area, and the vegetation is described as a whole made up of plant groups, fitted to live in the conditions of their environment and amongst their competitors, and having a history past and present. The first six volumes of the series dealt with portions of Europe, and have been reviewed in this *Magazine*, as they appeared, since 1897; they were Wilkomm on the Iberian Peninsula, Pax on the Carpathians, Radde on the Caucasus, Von Beck on Illyria of the Balkans, Graebner on the Heaths of the North German Plain, and Drude on Hercynia of Central Germany. The

¹ *Die Pflanzenwelt von West-Australien südlich des Wendekreises.* By Dr. L. Diels. (*Die Vegetation der Erde*, vii.) Engelmann, Leipzig, 1906. Price 36 M.

seventh volume, by Dr. L. Diels of the Berlin Botanic Garden, is extra-European and describes the vegetation of part of Australia, a British colony. One feels inclined to ask why it should fall to the lot of Dr. Diels to describe the vegetation of Australia—the land whose flora was first made known by Archibald Menzies, Robert Brown, James Drummond, and many another Briton who ranked high amongst the world's botanical explorers. It would be easy to give many reasons why these early botanists failed to do what Dr. Diels has done; the time was not ripe, and their arduous journeys were the foundation of what we know to-day. During several decades Australia has possessed botanical establishments under the guidance of able botanists, notably Ferdinand von Müller, to whose pioneer work this memoir owes much. Since Müller's time botanists have collected in Western Australia and other parts, but no one has attempted to sort out the vegetation of any large area and to study it in the manner now set before us. This is where Dr. Diels, trained in the methods of Engler, found his opportunity, not so much in exploring new lands as in studying carefully the distribution of plants over an area in which the species were fairly well known, and one which presented many important problems in geographical botany. The time actually spent in Western Australia was from November 1900 till December 1901, but this was preceded by two months in Cape Colony, and succeeded by further study of the vegetation of Eastern Australia and New Zealand. The present memoir is detailed and beyond our criticism, only general topics can be glanced at here and there.

An introductory chapter on the vegetation of the Australian continent is the best summary we have seen. Broadly speaking, Australia strongly resembles South Africa in its climate and forms of vegetation. The interior is an extensive and dry plateau with few rivers. On the eastern side high mountains fringe the plateau and fall abruptly to the sea; on the other coasts the plains are broader and the descent from the interior is more gradual. The climate of the north is tropical with summer rains, that of the south more temperate and with winter rains. Inland the rainfall diminishes rapidly, so that large tracts of the interior are liable to prolonged droughts, and are subject to a wide daily range of temperature, 20° C. being not uncommon. All these factors influence the vegetation, and the range of plant formations is wide. The rain-forest of the tropics of the Amazon, the Congo, and the Malay is found in a few limited areas between the east coast ranges and the sea, especially on the Bellenden Kerr Range. Dr. Diels notes the same features in this forest as those described for the African "Dark Forest": the sharply defined edge of the "Big Scrubs" in contrast to the open scrubs or savannahs adjoining; the tall trees carrying the canopy high overhead; the wealth of lianes swinging cable-like from tree to tree, mingled with masses of epiphytes above, and a dense tropical undergrowth wherever light can pierce the canopy. But the tropical rain-forest of Australia cannot be measured by marches of days or weeks, it is strictly confined to narrow limits where the rainfall is high and dispersed throughout the year. The temperate climate and winter rains of south-eastern Victoria

and Tasmania also favour forest-growth. Here the dominant trees include many giant Eucalypti, the Cabbage Palm (*Livistonia*), the Australian Araucarias and other trees not met with in the tropical forest; the massive lianes are replaced by slender forms (*Clematis*, *Smilax*, etc.), and the epiphytic Ferns and Orchids are less dense. The undergrowth includes so many ferns ranging from Tree Ferns downwards that the "Fern Tree Gullies" are one of the sights of Victoria. A third form of forest is met with on the uplands of Victoria, and again, more extensive, in the extreme southern angle of Western Australia; this is the "sclerophyll" or evergreen forest and bush familiar to travellers in the Mediterranean as the "Macchie" or "Maquis," with its shrubby Cistus, tree Heath, and evergreen Oak. In Australia, Eucalypti are important elements of the evergreen forest, the "Jarrah" and "Karri" being valuable timber trees, and smaller Blue Gums forming much of the lower bush. These forest areas, however, occupy small areas in Australia, which as a whole is not a timber-exporting country like Canada. The greater part of the continent is subject to periods of drought, and trees occur in a straggling fashion in groups, along water-courses and in other places where moisture is available. The Eucalypti are extremely characteristic of Australia, quite as much so as the Marsupials amongst animals. They are found under all conditions, as giants in lofty forests, as the chief element in the widely dispersed "Blue Gum" scrubs on the grasslands, and again as low scrubby trees or shrubs in the drier interior or on exposed mountain slopes. The bluish-green leaves in an edgewise position (not horizontal with an upper and lower surface as with our own trees), and the flower-buds protected by a lid which falls off as they open, these give the Eucalypti a fantastic appearance and are excellent adaptations against drought. Where trees or shrubs will grow, there the Eucalypti hold sway along with Acacias and other trees, and one will look in vain for the Conifers (*Abietinæ*), the Oaks and the Birches of the Northern Hemisphere. The following list of the plant-formations shown on the vegetation map in this book will give a glimpse into the character of Australian vegetation:—

Type of Vegetation.	Principal Tree.	Under Shrubs.	Surface Vegetation.
Tropical Rain-forest.	Mixture of many trees.	Numerous shrubs.	No grass.
Temperate Rain-forest.	Eucalyptus dominant.	A few shrubs.	Little grass, many ferns
Sclerophyll forest.	Eucalyptus dominant.	Numerous small shrubs.	No grass.
Savannah forest.	Eucalyptus or Acacia in groups.	Few or no shrubs.	Much grass.
Savannah.	A few low trees or shrubs.		Much grass.
Mulga scrub.	A few low trees or shrubs, chiefly Acacia.		Little grass.
Brigalow and Mallee scrub and Sand-heaths.	Numerous low trees or shrubs; Acacia and Eucalyptus abundant.		No grass.
Desert.	Scattered shrubs; Acacia and Casuarina.		Little grass, chiefly <i>Triodia</i> .

The greater part of the memoir is descriptive of the vegetation of Western Australia south of the Tropic of Capricorn. There is an

excellent historical account of the botanical exploration from the earliest records of Dampier at the close of the seventeenth century on to the present time. The whole is a record of much labour and progress, but an interesting diagram shows that much ground still remains to be explored. Diels divides Extra-tropical Western Australia into two provinces: the South-west, which lies along the coast from Shark's Bay to Esperance Bay in the south; and the Eremæa or inland province which approaches the coast north of Shark's Bay. The limit between the two provinces almost coincides with the rainfall line of 40 cm. (16 inches) per annum; in the South-west province the rainfall increases towards the coast, attaining 125 cm. on a narrow strip between Albany and Karridale; Perth has about 75 cm. The Eremæa rainfall is scanty, Coolgardie ranging about 25 cm. The zones of vegetation approximately follow the rainfall lines. A coast zone of bush and open forest becomes further inland the dense Jarrah and Karri forest; this gives place to open Eucalyptus forest, which dwindles to scrub on the margin of the Eremæa. This latter is a monotonous region with no well-defined valleys, the water-courses being only temporary in the winter-rains. The Eremæa is to south-west Australia as the Karroo is to Cape Colony, a dry desert during many months, subject to wide ranges of temperature. The South-west province is rich in Cycads, Proteaceæ, the heath-like Epacrids, Orchids, and many other species. The Eremæa is poor floristically, but during the rains there is a good display of brightly coloured Compositæ and other annual and bulbous plants. Economically the South-west province has valuable forests of Jarrah and other Eucalypti, and in the moister valleys cereals, vegetables, and fruits of the temperate zone flourish. It was here that the first settlement in Western Australia took place, and progress into the dry interior has been slow, so that on the whole man has not yet influenced the vegetation to any great extent. In the Eremæa the author does not anticipate extensive cultivation until irrigation is instituted on a large scale.

It would be a task to attempt to summarise Dr. Diels' detailed description of the two provinces. His method is to describe the indicator plants of each sub-division, and with the aid of numerous figures, to point out the ecological adaptation of leaf, stem, flower, etc., to the conditions of the environment. The appearance of the plant-formations is presented in a series of photographs which range from the Mangrove groves of the coast and the coast-scrubs to the forests of Jarrah, Karri, and other giant Eucalypti, and through other scrubs to the salt-encrusted soils of the interior. The great variety in Eucalypti and Acacias is presented by these photographs most forcibly. The figures also convey some idea of the great interest of south-west Australia from the floristic outlook. The Proteaceæ, a most interesting group, is represented by many species of *Banksia*, *Heulca*, *Grevillea*, and other genera. Closely following these comes the Myrtle order, with many species of *Melaleuca*, including the Silver-leaf Tree. The majority of the species are confined to the moist South-west province; they disappear in the dry interior, but reappear again in the eastern coasts. South-west Australia presents an interesting problem in plant distribu-

tion, because a large number of species occur in this corner of the continent completely cut off from their allies by long distances; this is discussed at some length with the aid of a series of diagrams. North-east Australia has many links connecting its flora with that of the Malayan region, and south-east Australia is related through New Zealand forms to the Antarctic floral region. These elements of the flora, however, which link up eastern Australia to other floral regions, are missing almost entirely from south-west Australia, and thereby making the isolation of its flora still more conspicuous. A certain resemblance to the flora of South Africa led Sir Joseph Hooker to his well-known theory of a common origin. It is certainly noteworthy that the natural orders—Proteaceæ, Restiaceæ, and others—recorded by Hooker are represented by more species in South Africa and Australia than in any other part of the earth. Does this indicate a common origin—a former great Antarctic continent suggested by some—or is it to be ascribed to convergence? Dr. Diels does not attempt to settle the difficulty, but he considers that the resemblance is superficial and due to similar climatic and topographic conditions. It is observed that trees are subordinate elements in the Cape flora, whereas in south-west Australia they dominate large areas extending even on to the Eremæa plateau, the equivalent of the treeless Karroo of South Africa. On the other hand, south-west Australia cannot lay claim to that wealth of succulent and bulbous plants so characteristic of South Africa.

The Vegetation of Western Australia will take its place amongst the best of these works which within recent years have done so much to raise the plane of botanical geography towards the place it ought to hold. The author's task has been no easy one, since it involved the sifting out of essentials from a great mass of details which in too many instances have drawn off attention from the main issue. Appreciation by us may be best expressed by a hearty recommendation of the work to all students of plant-geography without restriction to those interested in Australia only.

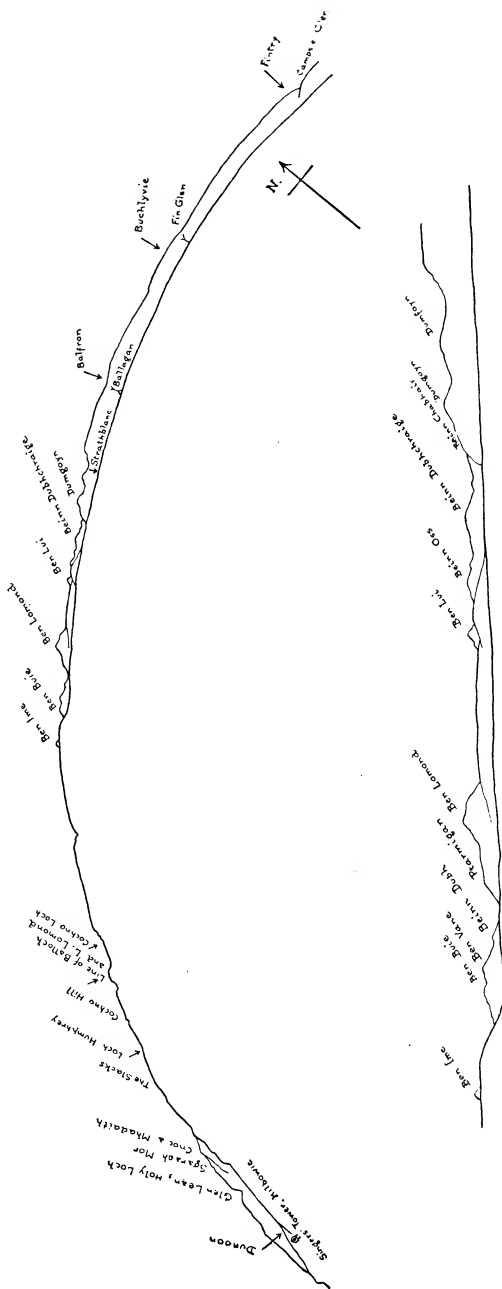
THE SOUTHERN HIGHLANDS FROM GLASGOW.

By JOHN FREW, M.A., B.Sc., and FREDERICK MORT, M.A., B.Sc., F.G.S.

(*With Figures.*)

In June 1906, in this *Magazine*, we described the first of a series of drawings to be used in identifying the peaks of the Southern Highlands from the Clyde valley. This article described the view from Dumgoyne in the northern part of the valley; the second set of drawings, published in August 1906, showed the Highlands from Gourrock, and the drawings in this issue show the hills as seen from Glasgow. The three papers thus describe respectively the outlook from the north, the south, and the centre of the Clyde valley.

SOUTHERN HIGHLANDS FROM SPRINGBURN, GLASGOW.



As was to be expected, the atmospheric difficulties were very considerable in surveying distant hills from a city so smoky as Glasgow. Repeated expeditions during a period of nine months were made to the two observation stations without success, until two or three successive days in May of exceptionally clear weather, and with the wind in the right direction, enabled us to secure the necessary readings. At first we used a prismatic compass for this survey, and although this gave a result over the range accurate within one degree, we felt that enough reliance could not be placed on these readings and so discarded them completely. The angles were therefore taken as before with the theodolite and transferred to maps, while the final outlines were made from drawings and photographs. The second diagram in each plate shows an enlarged view of the most interesting part of the range.

We selected Ruchill Park and Springburn Park as the best points from which to take observations. The highest part of the former is an artificial hillock known locally as the "Mound" or "Spion Kop," from which a very fine view can be obtained on a clear day. There is a corresponding hillock in Springburn Park, but the view from it is intercepted by buildings, and until it is raised several feet it is worse than useless as an observation point, for it draws people from the place where an uninterrupted view may be obtained. The point from which our drawings were made is beside the Reading Room, and on a stretch of grass between it and the road.

We are enabled to see several interesting Highland peaks from Glasgow, because there is fortunately a gap in the line of volcanic hills to the north-west. The Campsie Fells and Kilpatrick Hills were doubtless originally one continuous range, but a great notch has been cut into them, and this gap is now known as the Blane Valley. The stream that runs in this valley at the present time, the Blane Water, is a tributary of the Endrick flowing west into Loch Lomond, and seems far too insignificant to have cut the great opening that one looks through from Glasgow. The explanation of the discrepancy is given in Cadell's classic paper on the Dumbartonshire Highlands published in this *Magazine* in 1886. The valley was probably originally the outflow of the drainage from the district west of Loch Lomond before that loch came into existence. Its river was of considerable size and flowed eastwards towards the Forth. After the water supply was cut off by the formation of Loch Lomond a small stream originated in the valley with a flow in a direction opposite to that of the first river. This stream is the Blane Water, a tiny rivulet that seems almost lost in its large valley.

As one walks up the short hill towards the gate of Springburn Park, a fine conical peak is visible at the edge of Dumgoyn, but on entering the park the view of it is just cut off. This is Beinn Chabhair, which is well seen from Ruchill. Of the Highland peaks visible from this point the most distant is Ben Lui $39\frac{1}{4}$ miles off. Ben Lomond is $24\frac{3}{4}$ miles away, and Dumgoyn $9\frac{1}{4}$ miles.

We have shown the Kilpatrick Hills and the Campsie Fells in both drawings, although they cannot be classed as Highland. Both ranges present some interesting points. They are remnants of the great lava

plateau, the material of which gushed from hundreds of volcanoes in early Carboniferous times, and stretched from Stirling to Campbeltown. They are built up in layers, each bed representing a distinct eruption, and this can be very well seen from both Glasgow stations. At Cochno Loch, or to the right of Dumfryn, a series of steps can be clearly recognised, each step representing a different lava flow. It was this phenomenon that gave the name "trap" to these rocks, from the Swedish "trappa," a stair. A look at the Spout of Ballagan through a field-glass is worth while. There are visible here the sedimentary rocks that underlie the volcanic lavas. To the extreme left of the Kilpatrick the Highland chain is seen again at Cnoc a Mhadaith, behind Kilmun, and still farther the deep notch of Glen Lean.

The Highland peaks that can be seen from Springburn are shown in the following table, with their heights and angular distances from Dumgoyne, which stands out conspicuously at the end of the Campsie Hills.

MOUNTAINS SEEN FROM SPRINGBURN.

Mountain.	Height.	Angular distance from Dumgoyne.
Beinn Chabhair, . . .	3053 feet	1° 32'
Beinn Dubh-chraige, . . .	3204 "	2° 41'
Beinn Oss, . . .	3374 "	4° 18'
Ben Lui, . . .	3708 "	5° 29'
Ben Lomond, . . .	3192 "	9° 58'
Ptarmigan, . . .	2398 "	11° 31'
Beinn Dubh, . . .	2509 "	12° 44'
Ben Vane, . . .	3004 "	13° 32'
Ben Buie, . . .	3106 "	14° 1'
Ben Ime, . . .	3318 "	16° 24'
Cnoc a Mhadaith, . . .	1535 "	45° 46'
Sgarach Mor, . . .	1972 "	47° 16'

The peaks visible from Ruchill Park are shown in the following table.

MOUNTAINS SEEN FROM RUCHILL.

Mountain.	Height.	Angular Distance from Dumgoyne.
Stob Garbh, . . .	3143 feet	2° 52'
Beinn Tulachan, . . .	3099 "	3° 3'
Cruach Ardran, . . .	3477 "	3° 40'
Beinn Doireann, . . .	3523 "	3° 51'
Stob a Choin, . . .	2839 "	4° 25'
Beinn a Chroin, . . .	3101 "	6° 6'
Beinn Chabhair, . . .	3053 "	8° 58'
Beinn Dubh-chraige, . . .	3204 "	11° 20'
Ben Lomond, . . .	3192 "	17° 17'
Cnoc a Mhadaith, . . .	1535 "	55° 20'

A glance at the two drawings will show the considerable change in

the peaks to be seen, made by the seemingly slight shift of the point of view from Springburn to Ruchill. On the extreme right the distant range is seen to be rising into a mountain which is just cut off by Dumgoyn. If the valley had been a very little wider at this point we should have seen Stobinian and Ben More. Cruach Ardran is not named on the drawing, but it may be seen just to the right of Beinn Doireann. The most distant peak visible from Ruchill is Beinn Doireann, 47 miles from Glasgow in a straight line. Places of interest that lie behind any of the hills shown, but are not themselves visible, have been indicated by arrows pointing downward.

THE BRITISH ANTARCTIC EXPEDITION, 1907.

By E. H. SHACKLETON.

THE plans of the expedition can now be defined with greater precision than when the first announcement was made some months ago. (See p. 160.)

King Edward VII. Land, at the eastern end of Ross's great ice barrier, has been selected as the base of operations in place of the headquarters of the *Discovery* Expedition at the other end of the barrier.

For the purposes of the expedition a Newfoundland sealing steamer named the *Nimrod*, of 250 net tonnage, capable of carrying three hundred tons of coal in addition to all supplies, has been purchased. The work of equipment will be hurried forward with a view to departure on the long voyage to the south by the end of July. I expect to accompany the vessel on the outward voyage only as far as Madeira, to see that everything is in proper working order. Arrangements are being made for the accomplishment of an important magnetic survey. A special compass platform will be erected at a height of between thirty and forty feet from the deck, and all iron fittings in its neighbourhood will be replaced by brass fittings. Regular magnetic observations will be taken, and every five hundred miles the ship is to be "swung" for deviation and variation. Returning from Madeira I expect to start finally for New Zealand about the middle of October and to rejoin the *Nimrod* at Lyttelton. The experience of the various voyages that were made through the pack ice in connection with the *Discovery* Expedition went to show that the later the start the more favourable the conditions, as the pack ice is dispersed by the end of January; and accordingly I do not propose to sail from Lyttelton till the end of the first week in the New Year. The united expedition at that time will probably number twenty-eight members, including a landing party of twelve. King Edward VII. Land it is hoped to reach by the 1st of February, and after landing myself and those who are to winter with me in the Antarctic, the *Nimrod* will return to New Zealand, and during the next eight or nine months devote as much time as possible to the continuation of her

magnetic survey along the great trade routes between New Zealand and Australia, and from Australia across the Indian Ocean.

With the exploring party will be landed on King Edward VII. Land the sections of a carefully planned living hut, twelve Siberian ponies, a team of twelve picked dogs from the far North-West of Canada, and the specially constructed motor car which will form such a novel feature of the expedition. Work will at once be started in accordance with a definite programme. While the hut is being erected and the winter quarters otherwise put in order, the closing days of the Antarctic summer will be utilised for establishing a line of dépôts as far, it is hoped, as 150 geographical miles to the south. The part of King Edward VII. Land, at which it is hoped to effect a landing, is in about $77^{\circ} 30'$ S. latitude, or 750 geographical miles from the Pole. During the winter the scientific studies, for the pursuit of which the expedition will be fully equipped, will absorb a large share of attention. All through, indeed, I intend to couple with exploration the work of scientific investigation, and during the year which we expect to remain in the far south, three of the members of the party—the geologist, the biologist, and the magnetician—will devote themselves entirely to their special researches within a radius of a hundred miles or so of the winter quarters.

With the return of spring efforts will be made to extend the line of dépôts another hundred geographical miles to the south—that is, to within five hundred geographical miles of the Pole. As on the *Discovery* expedition, the party which will attempt to reach the South Pole will be limited to three members. With us we will take six of the Siberian ponies and the motor-car, which, constructed by the Arrol-Johnston Company, of Paisley, is made of steel specially adapted to withstand extreme cold. It will be driven by a spirit which will work satisfactorily in low temperatures, and is provided with three different sets of wheels for use on surfaces of different softness. Great hopes are entertained of its value for traction purposes, but I recognise that its employment is an experiment, and the chances of the expedition's success are far from being centred in any such novel means of locomotion. The use of Siberian ponies in the Antarctic is also in the nature of an experiment, but the hardiness and strength they have developed on the bitterly cold plains of Eastern Siberia, where they are accustomed to live in the open all through the winter, justify the hope that the experiment will be a success. In the final resort there will be the dogs to fall back on. The comparative failure of the dogs on the *Discovery* Expedition was in part, at any rate, due to the deterioration of their food in passing through the tropics. To all the food arrangements I am devoting the most careful attention, and, benefiting by experience, hope to avoid in this respect the misfortunes of the National Expedition. Thus fortified in every way that human forethought can suggest, I hope to reach a high southern latitude, if not the Pole itself. But the southward journey will not be the only important exploration undertaken. A second party of three, with three of the Siberian ponies, will be detailed to penetrate in a south-easterly direction behind the coast of King

Edward VII. Land, while a third, also composed of three members, with three of the ponies, will seek to follow the coast round in the direction of Alexandra Land. So little is known of all this region that whether or not all our hopes are realised, these journeys of exploration can scarcely fail to result in most interesting additions to our geographical knowledge of the South Polar area.

The return of the *Nimrod* has been fixed for about the end of January 1909. Against any possible failure of the ship to keep the appointment the landing party will be doubly guarded. Not only shall we take out with us food supplies for two full years, but we shall be provided with a first-class lifeboat, equipped with a motor-engine and capable of carrying provisions to last a party of twelve for two and a half months. If, as is planned, the ship picks up the party early in 1909, the course of the vessel will be directed to the Balleny Islands, off the northern end of Victoria Land, and the remainder of the summer will be devoted to a westerly cruise, as near as the ice will permit, to Adélie Land, Clarie Land, and the other patches of coast extending westwards to Kemp and Enderby Lands, which go by the general name of Wilkes Land, after the American explorer who visited that region some seventy years ago. We propose to pursue a zigzag course, taking soundings the while, for the purpose of discovering the limits of the continental shelf—supposing that the various patches of land that have been sighted do in fact form part of the hypothetical Antarctic continent. After pursuing the westerly voyage as far as the season will permit, the expedition will turn northwards and eastwards again, and commence the homeward voyage across the India, Pacific, and Atlantic Oceans, continuing to accumulate magnetic observations that should be of considerable practical value to mariners as well as of scientific interest.

THE FUTURE OF JAPAN: A REVIEW.¹

THIS is a striking and in some respects a startling book, well worthy of perusal and consideration. The criticism, while full and searching, is kindly and sympathetic. We will try to indicate briefly the writer's main conclusions as far as possible in his own words.

Modern Japan dates from the Revolution of 1868. That revolution was mainly the work of a small band of leaders—some fifty-five in all—Samurai or nobles for the most part, but without great social rank or official standing: so far as it came from the people at all it arose from the national exclusiveness and objection to the agreements with foreign powers into which the Shôgun had entered. This feeling was made use of by the Samurai leaders to overthrow the Shôgunate and to restore the power of the Emperor, and then in his name to carry out still further the expansive movement which had begun, and to throw Japan open to all the influences of the West. The great quest of these leaders was

¹ *The Future of Japan.* By W. Petrie Watson. London, Duckworth. 10s. 6d. net.

to discover the best methods of foreign countries and to apply them: Germany and France, Britain and the United States, were put under contribution with the supreme object of placing Japan on an equality with the great nations of the world. The methods thus borrowed and applied have been eminently rich in results: education has been organised, law has been codified, a navy has been created, the army has been re-built from its foundations; railroads, a banking system, a postal system, telegraphs, docks, lighthouses, newspapers, universities, all the external characteristics of a progressive civilisation have been imported into and "erected" in the country. All that the Government has undertaken is done with marvellous thoroughness and efficiency, notably in everything that concerns the military services with regard to previous preparation, to the equipment and management of hospitals, to secrecy and promptness of action, and to conduct in the field. This brilliant success, however, has been the work of a few statesmen rather than of the nation. Nowhere is there a greater chasm between the rulers and the ruled. The leading statesmen are not politicians but administrators—great civil servants acting for the interests of the people, but hardly through the people. The political franchise is confined to somewhat less than half a million out of a nation of forty-two millions. There is a Diet of two Houses, but the ministers are responsible to the Emperor, not to the Diet, and the real driving force does not lie even with the ministers but with the "Elder Statesmen," as they are called, an informal unconstitutional body that stands at the back of the cabinet of the day. Further, besides this political powerlessness of the mass of the nation, there is another and more serious consequence of this government from above—the lack of individuality and self-reliance. There is a striking contrast when we turn from State action to that which depends on the initiative of individuals. Here we come across another and a distinct Japan: we find a people with charming qualities, cheerful optimists with a capacity for contentment with small things. Here are no crying children, no grumbling old men, no petulant old women. On the other hand, they have the defects of their qualities: there is no punctuality, no precision, no high standard of work, but an acquiescence in an almost all-prevailing bribery and corruption.

It cannot be said that the author fails to realise the great difficulty of harmonising these two views of Japan, or of explaining how the absence of individuality and of self-reliance can be reconciled with the intelligent action, with the conscious co-operation, with the devotion and the supreme power of self-effacement for the common weal that have distinguished Japanese military action by land and sea, that have extorted admiration from unfriendly nations, and have illuminated their recent annals with an imperishable memory. He labours to explain this "antimony" and contradiction, but fails, in our opinion, to carry full conviction to his readers. The intelligent working of a system so complex in its ramifications, the orderly combination of all conditions of men towards the accomplishment of the common aim, would seem impossible of attainment without more individual self-reliance than this interesting volume credits to the Japanese. The truth that underlies

his contention need not be denied, but it would seem to have been exaggerated till it has overborne his sounder judgment.

The writer breaks fresh ground when he points out that the Revolution of 1868 that caused the downfall of the Shōgunate and of feudalism, also strained the bonds of social order, and that the ties that hold together the new Japan that has since come into existence are of feeble force. Of such ties the first that naturally occurs to our minds is "Bushido"—"the way of the warrior"—at once the maker and the product of old Japan, "the source from which sprang the motives of men's noblest actions." The leading virtues which this way of looking at life evoked may be said to be Frugality, Fealty, Filial Piety. Its influence is not yet dead; that it still remains an animating spirit in modern as in pre-modern Japan is amply testified by the late war with its abundance of heroism, of self-command, of indifference to life. But it is the ideal morality of the "Samurai," of the noble military class, that is disappearing under the revived power and majesty of the Crown, and is insufficient in extent and in moral meaning as a basis for the civilisation of the Japan of our own day and of the days to come, the Japan of commerce and of industry.

A more potent and enduring bond is to be found in the Family. The conception of the Family as a social unit and of the State as a larger Family, crowned by the headship of the Emperor, and consecrated by the religious sanction of ancestor worship, is likely to remain a leading and unifying influence in Japan. The Japanese family descends in the male line, its constituent elements are father and son, not husband and wife; the woman is merely a necessary accident; the idea of "home," home which is made by the woman, which is the centre from which her social influence spreads, does not enter into it.

The third great bond of society is the sense of patriotism. "This is a new and powerful emotion to the Japanese, a product of the conditions of their modern era." Amid all the difficulties connected with the reconstruction of the polity and civilisation of their country, in face of the imminence of a struggle with a great foreign Power, the sustaining principle has been the consciousness of the Nation. This consciousness has found support in the permanence of the Family as expressed in ancestor worship and in the divinity of the Emperor as the mysterious and sacred embodiment of the State. It has assumed the character and the functions of a religion.

To Religion, however, itself, as we understand it, the Japanese mind seems at present indifferent. The more intellectual have been infected with the scepticism of Modern Western Philosophy; the progress in wealth and in power achieved during the last few years have developed in others a materialistic view of life; above all, the two great conceptions which, to use the language of a Japanese Christian, are necessary to unlock the ultimate secret of Christianity, are not easy for the mass of the people to grasp. These are the conviction of a personal God, and the conviction of a sinful self. So far, then, there seems little hope of the spread of Christian doctrine, yet there is another way of approaching the divine fact of Christianity, and with a people so generous in

their recognition of the heroic, it may be anticipated that a perception of the life and personality of its Founder may dawn upon them amid the wreck of their ancient ideas and of their present religion of loyalty. With these words of hope the author leaves us.

One comment may be added. We must remember how young, how new the civilisation of modern Japan is, how easily and with how little effort everything had come to them till within the last years. Others had laboured, and they had entered into the fruits of their labours. Now they too have paid the price of suffering without which growth is impossible, and it is too early yet to estimate the moral and spiritual significance of the silent sacrifice, the unflinching devotion to duty, which illustrated the war and astonished an unsuspecting world.

GEOGRAPHICAL NOTES.

EUROPE.

The Fauna of Great Britain and Ireland.—In the *Irish Naturalist* for April there appears a report of a paper on "The Problems of an Island Fauna," read by Mr. C. B. Moffat to the Dublin Naturalists' Field Club. The paper contains an interesting suggestion as to the cause of the poverty of the fauna of Ireland as compared with that of Great Britain, and of Great Britain as compared with that of the Continent of Europe. The usual explanation, as is well known, is that these islands were cut off from the Continent before the missing forms had had time to reach them. Mr. Moffat regards this as an insufficient reason, partly because there is clear evidence that some of the forms which are now absent did at one time exist here, but have died out. It is thus not only a question of what we have failed to gain, but of what we have lost. His suggestion is that the reason of the poverty, here as in other island areas, may be in part due to the inherent weakness of those members of a species which inhabit the periphery of the distributional area of the particular species. In other words, it is suggested that on a given land area there is a tendency for the stronger and more fit forms to inhabit the more favourable situations, while the less fit are driven to the margins. If a portion of the periphery is subsequently cut off as an island, so that repeated colonisation becomes impossible, then the stock in the isolated region, prevented from intercrossing with more dominant forms, and no longer receiving fresh immigrants, may gradually die out from inherent weakness. The suggestion, whether true or not, is at least interesting.

The Distribution of the Population of Lower Languedoc.—In the *Bulletin* of the Société Languedocienne de Géographie (xxix.), M. Max Sorre publishes a series of articles on this subject, illustrated by a map and a series of diagrams, etc. The points of general interest are the complexity of the problems involved and the varying economic factors which have modified, and are modifying, the distribution and numbers

of the population. The author points out, in the first place, that the region is one which has been inhabited for a prolonged period of time, and that by a succession of intermingled races. Thus not only has there been time for man to adjust himself to the geographical conditions, but also the mixture of races make it probable that all the natural resources of the region have to some extent been utilised, for civilisation here is very old. In spite of this, however, equilibrium has by no means been completely attained, and the population has been and is fluctuating in an extraordinary way. The reason is obvious when we recollect that the two important cultivated plants of the region are the vine and the mulberry tree, whose associated industries have been of recent years greatly influenced respectively by the phylloxera and the silkworm diseases. The author's discussion of the relation between the economic crises induced by phylloxera and the diseases of silkworms and the variations of the populations of the different districts is exceedingly interesting, more especially as regards his demonstration of the way in which the introduction of resistant vine-stocks lead to an almost complete recovery of prosperity by the owners of vineyards, and a consequent return of the population to the devastated districts. He shows in detail how under the new conditions the distribution of the vine has somewhat altered, and with this alteration appeared a corresponding alteration in the distribution of the people. In the silk-producing districts the recovery has been much less marked, and the result is that while formerly there was economic equilibrium between the vine-growing and silk-producing districts, the destructive diseases named have disturbed this equilibrium, and at present the first-named is over-peopled, the latter under-peopled. In the vine-growing regions the density is now about 92 per square kilometre, while in the silk districts it is only about 62 per square kilometre. Further, there is a marked distinction between the two regions in regard to the nature of the settlements. In the vine region of the plain of the Herault a family can live on the produce of one hectare (about $2\frac{1}{2}$ acres). Cultivation is thus intensive, and the consequence of the small area required is seen in the predominance of communes of considerable size. On the other hand, in the silk-producing districts the population is scattered and the communes of smaller size, except where other occupations or resources are added to the rearing of the silkworms.

The connection between the above facts and the present "wine crisis" in the south of France is obvious.

The Origin of the River System of North Belgium.—In the *Bulletin d. l. Société Belge d. Géologie* (xx. p. 71, 1906), M. A. Briquet discusses the origin of the river systems of North Belgium. As a glance at the map will recall, the system is remarkable in two respects—first, in the remarkable "espalier" arrangement of the constituent streams; and second, in the communication of the whole system with the sea by an outlet which crosses the elevated threshold formed by the plateau region of the Waes and Campine. The explanation in detail is difficult to follow without the author's maps, but the essence of the matter may

be stated as follows:—In the first place, there are four periods in the evolution of the system, traces of all which are still obvious. We have, first, the period of the retreat of the Pliocene sea; second, the period of maximum erosion of the valleys which followed, and was contemporaneous with the period of maximum retreat of the sea. This period was followed by a new rise of sea-level, less extensive than that of Pliocene times, which was again followed by a renewed retreat and by the establishment of the existing conditions.

In the first period, as the Pliocene sea retreated, a system of consequent streams was established, consisting of a series of parallel rivers, draining towards the north-north-east, the direction of retreat of the ocean. The remnant of this condition persists in mid-Belgium and the north of France, where the Yser, Lys, Escaut, Dendre, Senne, Dyle, Geete, and Demer, in parts or in the whole of their respective courses, represent the remains of this primitive series of streams. To the north, on the other hand, the primitive arrangement has been obliterated by subsequent changes. On this primitive condition followed a process of differential erosion which resulted in numerous cases of river capture. The evidence goes to show that on proceeding westward each successive stream had greater excavating power than its eastern neighbour, and the result was to change the original south-south-west to north-north-east direction to an almost perpendicular one—that is, to turn the streams towards the north-west. Not a few of the existing streams show in the lower part of their courses remnants of this process. Thus the Escaut between Condé and Tournai has an oblique direction towards the north-west, above the latter place it regains its original north-north-east direction, the direction in which it flows above Condé. The causation, as has been shown by other writers, is the fact that the existing Escaut has captured the head-waters of the Dendre. Many other similar cases are discernible, and show that generally the excavating power of the streams increased towards the west. During the course of the second period the evolution of the river system proceeded until the process of capture had been carried so far that all the streams found a common exit in a channel which passed to the north-west of Ghent to enter the sea at some unknown point.

This was, however, preceded by a stage when the eastern trunks found a separate exit in the vicinity of the spot where Antwerp now stands. Later, the Ghent channel, which had greater excavating power, succeeded in capturing the feeders of this trunk, and became, as indicated, the sole exit of the system. There followed a new depression which flooded a large part of the Ghent channel, and also carried the waters of the sea into the interior by the old Antwerp channel. The result was that the upper portions of the tributaries of the old system flowed into the great inlets so formed as separate streams, and the drainage was thus restored to a primitive condition. When the new elevation took place and the sea retreated, the conditions favoured the eastern streams, which were in consequence enabled to capture the lower courses of their western companions, and the result was to establish the single existing trunk which enters the sea past Antwerp.

AFRICA.

The British Museum Expedition to Central Africa.—Dr. Wollaston, a member of the expedition which was sent out in October 1905 (cf. xxi. p. 661) by the Natural History Department of the British Museum to explore the Ruwenzori region, who has now returned to England, has communicated to Reuter's Agency an account of his experiences. Dr. Wollaston left Entebbe, the capital of Uganda, in September last, and worked his way through the province of Ankoli to Lake Albert Edward, where he crossed the Uganda-Congo frontier. He then proceeded down that lake in a boat lent by the Congo administration. From the south of Lake Albert Edward the expedition proceeded through the heart of the Mfumbiro volcanic region, traversing ground where no Englishman had ever been before. For the most part the volcanoes were extinct. There were nine of them altogether, the highest being about 14,000 ft. Near the top they are covered with dense bamboo, which is supposed to be inhabited by a race of pygmies, who make their abode there and live by raiding the villages on the lower slopes. Although the expedition spent five weeks among the volcanoes, it was not found possible to visit the people at their summits. Nothing is known of them beyond the fact that they are of diminutive stature, and, as they are far removed from the Congo forest pygmies, they are probably a new race. From the volcanic region Dr. Wollaston proceeded down a steep descent to Lake Kivu, which was found to be full of islands surrounded by a glorious range of mountains and supporting a very thick population. From Kivu the expedition travelled to Tanganyika through the unknown valley of the Rusisi, a very interesting and mountainous region. Tanganyika was reached at the north end at a place called Uvira. Here Dr. Wollaston came upon the sleeping-sickness country, and from this point through the Manyema country traversed a region devastated by this terrible plague. He describes the sights as being fearful, with people dead and dying on the roadside, as it is the custom of these people to turn out stricken natives to die. The expedition reached the upper waters of the Congo at Kasongo in February, and proceeded by canoe down the river to Ponthierville at the head of Stanley Falls, where it joined the railway to Stanleyville. Three hundred miles above Stanley Falls the new railway going up to Tanganyika, which will eventually connect with the Cape to Cairo railway, is in progress.

The Rainfall of German West Africa.—In the *Mitteilungen aus d. Deutschen Schutzgebiete* (xx. 1, 1907) there appears a long paper, with a rainfall map and numerous diagrams, on the rainfall in German West Africa, which sums up what is at present known on this subject. As is well known, from the point of view of physical geography this region of Africa can be divided into three zones, according to the nature of the vegetation. The coastal zone consists of stony or sandy desert, devoid of a covering of vegetation, or with at most a sparse covering of dune or steppe grass in the moister parts. Further inland is the steppe region,

where the grass reaches a height of $1\frac{1}{2}$ metres, thorny acacias occur, and cattle-rearing can be carried on. Further to the interior savannahs occur, with trees and bushes. The map shows that the three regions correspond roughly, the coastal to a rainfall from 0 to 150 millimetres (0 to 5·9 inches) per annum, the steppe region to an annual fall of from 150 to 450 m. (5·9 to 17·7 inches), and the savannah region from 450 to 700 m. (17·7 to 27·5 inches). In the coastal region a considerable area, that nearest the coast, has a fall of less than 50 m. (about 2 inches) per annum. The rainfall is greater both to the north and to the south of German territory, and the author, Dr. Ottweiler, considers that the facts go to show that the strip belonging to Germany is the driest and most desert part of West Africa. The region of greatest drought occurs between Walfisch Bay and Lüderitz Bay, where the precipitation is almost *nil*, and this in the author's opinion forms one of the driest, if not *the* driest, part of the earth's surface. On passing inland the rainfall increases, and as already indicated, the vegetation becomes more abundant. But generally it may be said that the climatic conditions are such as to render the economic development of the country a matter of great difficulty. Though the statistical evidence is scanty, the author is of opinion that, such as it is, it does not support the view that South Africa is in process of drying up.

In detail we may note that the rain of the interior is almost exclusively summer rain, and is brought almost entirely by winds coming from some direction between north and east. Further, it varies very greatly in amount from year to year, and falls for the most part in thunderstorms, or even in torrential downpours, so that a great part of the total annual fall may be included in a very short period of time. The causation of the dryness of the coastal region is interesting. The predominating winds here are southerly or south-westerly, that is, are sea-breezes, and the land rises with some rapidity from the coast. Elsewhere, as for instance in the British area, these are the conditions which produce a heavy rainfall. We have to note, however, that the winds in West Africa come from higher and colder latitudes, and in particular, that they blow over the cold Benguela current. The consequence is, first, that the air contains but little moisture when it reaches the land; and, second, that the cooling effect of its ascent is more than counterbalanced by the heating effect of the sun; thus its temperature never falls below condensation point. Again, the hills of Damaraland effectually prevent any moisture borne by easterly winds from reaching the coastal strip. These and other points are very well shown on the map, which also gives some very interesting examples of local rain-shadows. The paper in addition contains tables giving all trustworthy rain records for the region, whether official or unofficial.

AMERICA.

Glacial Erosion in Alaska.—In the *Popular Science Monthly* for February, Professor Ralph Tarr gives an interesting account of the hanging valleys of Alaska, as these may be seen when traversing the

famous "Inside Passage," that series of channels, canals and reaches which may be threaded for more than 1000 miles from Seattle to Sitka, in south-eastern Alaska, without ever entering the open ocean. In this journey along the coast of British Colombia and Alaska, the hanging valleys are so striking that they are constantly commented upon by persons not as a rule interested in geographical phenomena, and they are accompanied by certain peculiarities of topography, such as the U-shape of the valleys, the absence of overlapping spurs, and so forth, which markedly differentiate it from that of the ordinary type due to water erosion. Professor Tarr describes these peculiarities in detail, illustrating by a series of fine photographs, discusses fully the various hypotheses, apart from ice action, which have been put forward to account for the origin of the peculiarities, and comes finally to the conclusion that, except glacial action, there is no valid hypothesis in the field. He considers that the scepticism which still exists in certain quarters in regard to the possibility of glacial erosion on the grand scale required is due to the fact that geologists have chiefly studied the small and dwindling glaciers of the Alps. To these doubters he recommends a journey through the Inside Passage, and also to the fiords to the north-west of this, such as Yakutat, a journey which he believes cannot fail to bring conviction.

Another paper by the same author in the *Bulletin* of the Geographical Society of Philadelphia for January 1907 gives an account of a very remarkable advance which has taken place in certain of the glaciers of Yakutat Bay, Alaska. Professor Tarr first visited this region in the summer of 1905, and returned the following summer with the object of crossing the Malaspina glacier, which had been found by earlier parties to form an admirable highway for travel. To the surprise of the party, however, it was found that certain, though not all, of the glaciers of the region had experienced a sudden and marked advance, of such a nature that the ice was advancing upon what had previously been forest ground. During the visit of the party trees were constantly falling into ice crevasses, morainic material was being engulfed, fresh glacial torrents were developing, and in short there were clear evidences of rapid change still in progress. Some of the photographs of the previous summer are included in the article accompanied by those of 1906, and the contrast between the two is certainly very striking. Such a sudden change cannot be ascribed to climatic variation, and the only hypothesis meantime is that it was due to earthquake action. In the autumn of 1899, as is well known, this part of Alaska was visited by severe earthquake shocks, which caused marked uplift of the coastline. The earthquake was accompanied by violent shaking of the surface, repeated many times, which caused the dislodgment of great masses of rock. There can therefore be little doubt that in the high regions they would also cause great displacement of snow and ice. It is supposed that the effect of this was to start a marked wave of advance in those of the glaciers whose ice-meers were affected in this way, and that this wave of advance appeared suddenly on the lower ground after being propagated through the length of the glacier. A very striking photograph at the end of the

article shows the ice overwhelming trees in leaf at the margin of its advancing ice-cliff.

AUSTRALASIA.

Chamois in New Zealand.—According to a note in the *Times* an attempt is being made to acclimatise the chamois in New Zealand. A small herd, consisting of two males and six females, has been sent to the Government of New Zealand by the Emperor of Austria, and have arrived at Wellington in perfect condition. On their arrival the animals were taken to the Hermitage at the foot of Mount Cook, and their progress is being there watched with great interest.

POLAR.

Fauna and Flora of Spitsbergen.—In the *Bulletin* of the Société Languedocienne de Géographie (xxix. 3), M. De Baichis gives a picturesque account of Spitsbergen and its flora and fauna, together with some notes on the geology, topography, climate, etc. The paper is especially valuable in giving a brief general survey of our knowledge of the region and in the stress which it lays upon the differences between the western and eastern coasts of Spitsbergen, and also on the importance to Europe of the existence of this archipelago, of Franz Josef Land, and of Novaia Zemlia, in protecting Western Europe from the influence of the Polar currents.

In this connection it is worth note that politically Spitsbergen is not attached to any European power, and that in spite of the fact that in summer there is a certain amount of tourist and other traffic to it, and it is probable that the coal, which is of good quality, will acquire increasing importance. This coal made its appearance in the market of Europe for the first time in 1904. According to a note in *Petermann's Mittheilungen*, towards the close of the last year there was some correspondence in the Norwegian and Swedish papers on the subject, each country claiming the right to annex the group. It would appear that the question cannot long remain undecided. A conjoint project between Russia and Norway for the establishment of a scientific observatory, suggested some years ago, has apparently fallen to the ground.

The Second Belgian Antarctic Expedition.—On May 12, a meeting was held at Brussels to discuss ways and means of forwarding Mr. Henryk Arctowski's second Antarctic expedition (cf. p. 263). It is proposed to reach the edge of the ice-pack early in the season in which the start is made, in about long. 100° W., and to spend some months in making hydrographic and magnetic observations. At a suitable opportunity efforts will be concentrated on making a way through the pack to the Antarctic coast, trusting to the prevailing easterly winds to bring the expedition to the neighbourhood of Edward VII. Land, where the vessel may be able to go into winter quarters at the edge of the ice-barrier. Efforts will be made during the following spring to penetrate to the south by means of automobiles. It is intended that the expedition shall be fitted out for two winters and three summers.

The Wellman Polar Expedition.—Mr. Walter Wellman and his party left Tromsø on June 3 for Spitsbergen with the airship *America*. Mr. Wellman hopes to start for the Pole on some date between July 20 and August 10, but if necessary the start will be made as late as August 20. Some modifications have been made in the airship, which will accommodate ten or twelve men, twelve dogs, and enough food to last the crew ten months.

New Antarctic Expedition.—It is announced that Dr. F. A. Cook is to lead an Antarctic Expedition next year. Dr. Cook proposes to establish a base camp near the *Discovery's* winter quarters on Erebus Island, and to attempt to reach the South Pole by motor car. It will be remembered that Mr. Shackleton intended at first to make Erebus Island his headquarters, but he has now changed his plans, and proposes to establish his base on Edward VII. Land (cf. article p. 372). Dr. Cook was a member of the Belgian Expedition in 1897-99, and also made the first ascent of Mount M'Kinley in Alaska last year.

COMMERCIAL GEOGRAPHY.

Progress of Argentina.—We have received from an Argentine correspondent some notes on the progress of this country. In the ten years from 1895-1905, the area under cultivation has increased by 170 per cent., the actual increase being 20,687,898 acres. The greatest increase has been made with regard to alfalfa, and is due to the fact that within the last five years it has been discovered that this plant will flourish on the salty, sandy sands to the west, which had been previously regarded as barren. Other cultivated plants have shown a steady if less marked increase. In regard to wheat production the country now takes the third place in the world, while its production of maize is only second to that of the United States. With the improvement of methods of agriculture there has been a tendency for the very large estates to be split into smaller ones. It is estimated that in the decade the total number of live-stock animals has increased by more than eight millions, the increase in cattle and sheep accounting for by far the greatest part of this figure. Horses, on the other hand, show a decrease of nearly a million.

Minerals in Ireland.—Recent careful investigations in Ireland have shown the existence there of an unexpected wealth of iron ore. The chief part of the iron worked in Ireland of recent years, apart from the bog iron ore of Donegal, has been found interbedded with the Antrim basalts in the neighbourhood of Cushendall, but new mines will probably be developed further to the north in Antrim, and at one or two points in the county of Londonderry. Here hæmatite, bauxite, gannister, and manganese have been found. Large quantities of bauxite have been found near Portrush, while rich hæmatitic veins have been discovered in the neighbourhood of Draperstown in southern Londonderry. Both the bauxite and the hæmatite are easy of access, and it is hoped that sufficient

of the latter at least may be produced to form an export trade with Great Britain.

The Harbour of Bruges.—Students of Belgian history know that in the fourteenth century Bruges, in spite of its inland position, was one of the most important commercial cities of the world. It stands on an arm of the sea, the Zwyn, which then formed a good inland harbour. Alterations of the coast-line led, however, to great silting up of this inlet, and, despite all that could be done, by the end of the fifteenth century the port had greatly declined in favour of Antwerp. Some eleven years ago elaborate works were undertaken with the object of restoring to the city some of its earlier importance. These works, fully detailed in a recent issue of the *Times*, comprise three parts, an outer port at Zeebrugge on the sea-coast, a sea canal, and an inner port at Bruges. The port, though only officially open this spring, has been in use for two years, and the opening of the canal is to be celebrated by elaborate fêtes this summer. Zeebrugge is situated thirteen miles to the east of Ostend, and leads by a sea canal eight and a half miles long to the port of Bruges. It is hoped that the whole scheme will enable Bruges to regain its old position as the foremost port of Belgium.

Railway Schemes in Switzerland.—The process of railway construction in Switzerland continues at a rapid rate. Among the latest schemes is one to connect the St. Gothard and Simplon routes, by the construction of a line from Brig towards the Rhone Glacier. The line will be about thirty-one miles in length, and will pass through a number of stations in the Upper Valais to which access is at present only obtainable on foot or by diligence. The line will be worked electrically, the power being derived from the upper Rhone, and the difference of level between the extremities will be about 3450 feet. Another scheme is to construct a branch line to Leukerbad from the Rhone valley line, which will facilitate the approach to the Gemmi. Further, there seems some prospect that in the near future the whole railway system of Switzerland may be electrified.

Mr. Andrew Watt has been elected Meteorological Secretary of the Scottish Meteorological Society in succession to the late Dr. Buchan, F.R.S. Mr. Watt has since 1900 been closely associated with Dr. Buchan in the discussion of rainfall and other meteorological problems.

EDUCATIONAL.

IN his anniversary address to the Royal Geographical Society on May 27, the President, Sir George Goldie, departed from the usual practice of summing up the chief geographical events of the preceding twelve months, in order to concentrate attention on the effects of the Civil Service Commissioners' decision that geography shall cease to be a subject for the examinations for the Foreign Office (cf. p. 10). Some

paragraphs of this address, which have a direct lesson for us, may be quoted here from the report of the speech:—

It was inevitable, said Sir George, that this remarkable decision should arouse a great deal of public attention, mainly, of course, on the ground of the maintenance of our national and Imperial interests which came into touch with those of foreign nations in so many parts of the world. That was, no doubt, a consideration worthy of much attention, but he was concerned to make it clear that the question was one of far wider importance than as merely affecting the efficiency of certain of our public services. That this fact had been so little recognised was, he thought, due to a natural and even commendable repugnance on the part of cultured minds to admit that our educational systems, based nominally, and to a large extent really, on intrinsically sound educational principles—such as developing the thinking powers of the student, strengthening his judgment, quickening his perceptive faculties, and cultivating his memory—had also necessarily rested largely on what, for want of a better phrase, he described as financial considerations. These fell into two divisions. The first of them affected directly only the Universities, but it affected indirectly the educational systems of all the non-State-aided schools in this country, as these, for various reasons, based their systems entirely on those adopted by the Universities. It was a serious misfortune that but few of the latter had been in a position to set apart sufficient funds for the endowment of a chair in geography or a school of geography. Yet he did not know a single instance of a University in the United Kingdom which was indifferent on this question of geographical education. So far as he could gather—and he had taken considerable trouble to ascertain the general trend of feeling—nothing but the want of money prevented any of the Universities from following the examples of Oxford, Cambridge, and London. But in most cases their too scanty funds were already appropriated to older established branches of study which no thinking man would wish to see starved. Unfortunately, the Royal Geographical Society had no extensive resources of its own with which to come to the assistance in this matter of the Universities generally. It had for years shared in the maintenance of the schools of geography of Oxford and Cambridge; but it would not be justified in advancing much further in this direction, in view of the heavy and urgent calls made upon its resources in entirely different directions. If, however, amongst its Fellows, or its sympathisers, there were any who were able and disposed to aid the advance of human knowledge by endowment, he did not think that they could better serve their purpose than by contributing to the founding of a chair of geography at any one of the Universities as yet unprovided with a geography school. The other division of financial considerations to which he alluded was of a less simple nature, but it was not less effective in blocking the progress of geographical education and the introduction of this subject into the list of those eligible by candidates for the public services. To avoid misapprehension on this point he premised that he was not dealing at present with the educational systems of our State or rate aided schools which were not dependent on the favour of parents nor subject to competition with other schools. It would suffice to confine their attention for the moment to private schools, public schools, and, to some extent, Universities—that was to say, to institutions where the sons of the leisured classes, or the well-to-do classes, were brought up, and from which strata our educational ideas and systems had invariably filtered down to the less-favoured classes which were waging a daily struggle for bare existence. With rare exceptions, every educational institution, not supported by public funds, had

to some degree—though to a varying degree—to strike a tacit bargain with the parents of its students; the parents paying the money on which the prosperity, or, most frequently, the existence of the institution depended, and requiring in return, in the vast majority of cases, that their boys should receive such instruction as should best enable them to compete on equal terms with their fellow-students. The proprietors of private schools, the governing bodies of public schools, and even, though to a lesser extent, the Universities themselves, could not therefore afford to give the same prominence to a subject which carried no marks in the civil and military examinations that they gave to subjects which carried such marks. On the other hand, the Civil Service Commissioners naturally hesitated to demand proficiency in a subject which held only a secondary position, or sometimes no position at all, in the educational institutions of the country; and the question thus moved in a vicious circle. He did not, of course, imagine that all the sons of the well-to-do classes of this country competed in examinations controlled by the Civil Service Commissioners; but the proportion of them so competing was sufficiently large to affect very seriously the standing in the whole educational sphere of any subject according as it was or was not a means of gaining marks in the civil and military examinations; and it might be confidently asserted that if geography received the recognition which they desired, it would very shortly take its place in Great Britain, as it had long since done in the United States, Germany, and other countries, as one of the fundamental and indispensable elements in the education of childhood and youth. That this had not been the case up to now was probably due to the unintelligent and unmethodical manner in which the subject was taught until some 20 years ago, with the result that the majority of those who were to-day in a position to speak with authority retained an entirely false impression of its scope and objects. Certainly, during his own school life, the hour in the week devoted to geography was universally anticipated with strong aversion as a dreary exercise of the memory in acquiring names entirely divorced from the realities of life, so that one of the most human and interesting of all branches of knowledge, intimately connected as it was with the history of mankind, with our present occupations, and with our future development, was presented to them as an arid and flowerless waste. The new methods and conceptions of geography had been so frequently and fully placed before them by the most competent experts in their science that he would not attempt to summarise them. It was, indeed, to the University of Oxford, supported, as he could not doubt that it would be, by the Universities of Cambridge, London, Edinburgh, and other great centres of education, that geographers must look for a satisfactory solution of this important question: for, so far as could be gathered from correspondence on the subject which appeared in the columns of *The Times* some months ago, the Civil Service Commissioners were willing to consider the admission of geography as one of the voluntary subjects for examinations, provided the great Universities would give a lead. In taking such a step both the Universities and the Commissioners would have behind them an immense pressure of public opinion, owing to the sudden awakening both of interest in the Empire as a whole and of recognition of our widespread ignorance of its geographical conditions.

The above quotations may serve to suggest the far-reaching importance of the movement for the establishment of a chair of geography in the University of Edinburgh.

NEW BOOKS.

EUROPE.

Highways and Byways of Berkshire. By JAMES EDMUND VINCENT, with Illustrations by FREDERICK L. GRIGGS. London: Macmillan and Co., 1906. Price 6s.

This book, like the other volumes of the series, is a kind of apotheosis of a guide-book, and will be found equally useful and agreeable to those who actually wish to tour through the county, as to those who, in the author's words, prefer travelling by proxy in an armchair. Mr. Vincent is, as should be the case in a work of this kind, an enthusiastic admirer of Berkshire—so enthusiastic indeed that he seems to regard as a personal enemy any one who has shown a want of appreciation or even ignorance of its beauties or its history. We are led from one place of interest or beauty to another, with careful directions as to the road we ought to follow, and excellent descriptions of the spots we are to visit, made clearer by Mr. Griggs's charming illustrations. Questions of history, both local and national, of topography, of philology, of anthropology, are all discussed as the occasion presents itself. We read interesting accounts of such varied personalities as Wayland Smith, Tom Brown, Alfred the Great, the Fair Rosamund, and the late Lord Wantage. No doubt the success of the book is made easier by the fact that Berkshire contains such a long list of places of note in our national history, such as Windsor, Ashdown, Newbury, Reading, Wantage, and Godstow, to mention only a few. Altogether it may be recommended as one of the most excellent volumes of an excellent series. It may be added that its value is enhanced by a very complete index.

Edinburgh under Sir Walter Scott. By W. T. FYFE. With an Introduction by R. S. RAIT. London: Archibald Constable and Co., Ltd. Price 10s. 6d. net.

By Edinburgh Mr. Fyfe means both the material Edinburgh of Craigleith sandstone and the society of illustrious men that made it, as Mr. Rait proclaims in his short Introduction, the intellectual centre of Britain for the half century after Johnson's death. Naturally it is the latter that receives the greater share of attention. Yet of the many names put forward in support of Edinburgh's claim to literary and learned hegemony, some of the most noted will scarcely be found in these pages. This is a consequence of over-simplicity of method. The method is that of the critic of the *Eatonswill Gazette*. Mr. Fyfe has gone to Lockhart for Scott and to Cockburn for Edinburgh. When he has made a summary of Lockhart, and used it as a thread to string selected beads from Cockburn, he considers the task all but complete. It must be admitted that a good deal can be done in this way. Cockburn's portraits of professors can be worked into the story of Scott's university days; Braxfield, Eskgrove, Hermand, and the rest can be brought in *à propos* of his admission to the bar; and so with other groups. Apart from the danger of omitting men of importance, or mentioning them only by the way as in any ordinary biography, there is the further disadvantage that the two works here "contaminated" are on vastly different scales. Even as here reduced Scott appears as a colossus among cameos: justly perhaps in respect of his genius; inconveniently in respect of the professed subject of the book, *Edinburgh under Sir Walter Scott*. Whatever may be its faults of construction, the book's matter is, for the most part, as good as one could wish. It could hardly be other where sometimes a whole chapter, except one paragraph, or a paragraph and a few lines,

is direct quotation from Cockburn's *Memorials of his Time*. By assiduous reading one comes now and then upon something that is neither Cockburn nor Lockhart. "Jupiter" Carlyle, the *Scots Magazine*, and other authorities are sometimes drawn upon, and occasionally Mr. Fyfe himself comes forward. He adds a few up-to-date details of topography and a few allusions to the topics of to-day or yesterday. For example: "The name 'Queensberry House' is painted on the gate, and is also on a brass plate at the bell-handle. The building looks like a modern barrack, the windows having been pointed and freshened up for the visit of King Edward: very proper treatment for a 'House of Refuge,' if not for Queensberry House." Again of the National Monument: "Perhaps in an era of colossal fortunes, some *Individual* may anticipate the city—engrossed with its Usher Hall and water-fleas—and capture the national glory to crown with immortality his own proud name." There are several onslaughts, more violent than effectual, upon the Ballantynes, "the bounding brothers of Kelso," who are contrasted with Constable, "truly a great man, and in all respects a gentleman." In one place the table of contents seems to promise something new: "Dr. Joseph Black—Latent Heat—His personal Appearance—Anecdote of last Illness—His *History of Great Britain*—Forerunner of the Modern School." The name of the respectable but too little respected Robert Henry has dropped out. As a life of Scott Mr. Fyfe's book is readable and justifiable. For those who cannot obtain Cockburn it is much more, but a new edition of the *Memorials* would have been better.

ASIA.

Natives of Northern India. By WILLIAM CROOKE, B.A., of the Bengal Civil Service (Retired). London: Archibald Constable and Co., Ltd., 1907. Price 6s.

The editor of the "Native Races of the British Empire" series was fortunate in securing for a work on the tribes of Northern India Mr. W. Crooke, whose many valuable contributions to the science of ethnology, so far as it relates to India, have won for him a place in the foremost rank of living ethnologists. His official duties during a long residence in Northern India, his personal tastes and bent of mind, and his many local investigations of antiquarian and ethnological questions there have enabled him to acquire a thorough grasp of the subject and to speak with an authority which has long been recognised as second to none. In the volume now before us he assigns the northern tribes of India to three distinct races, viz., the fair Indo-Aryans, the best representatives of whom are the Kashmiri Brahmins; the dark Dravidians, for the purest examples of whom we have to go to the Nilgiris in Southern India; and the yellow Mongoloids, of whom the Lepchas of Bhotan and Sikkim are good specimens. The Indo-Aryans and Dravidians are dolichocephalic; the Mongoloids are brachycephalic. The Indo-Aryans came from the north or west, the Dravidians came from the south, and the Mongoloids came from the north of the Himalayan range; but now the three races have become so intermixed, at least in the north of India, that it is "impossible to say where one variety of man ends and another begins." After a perhaps necessarily but disappointingly brief description of the tribes in the northern and southern hills, Mr. Crooke takes up the much-discussed question of caste, and points out that the caste is a collection of families having a common name, and usually following a common occupation; also that it usually claims common descent from a mythical ancestor, and that it invariably is endogamous. He notes in passing that from the sacred books of the Buddhists and Jains it appears that the system of caste came into existence only some six centuries

before Christ. The greater part of this most interesting work is devoted to descriptions of the village and its industries, home life, the occupations of women, child life (including games and amusements), birth, marriage, and death rites. The concluding chapters deal with animism, magic, shamanism, and witchcraft. A perusal of the work leaves no doubt in the mind of the reader that the author was embarrassed and even hampered by the wealth of material at his disposal and the necessity of compressing the work within the limits which had been prescribed. Every page in it is full of most interesting and instructive matter, and will be read with much profit and enjoyment not only by the general public, but especially by those who have lived some time in the scenes inhabited by the strange and interesting peoples whom Mr. Crooke so accurately and felicitously describes. Our only regret in closing the book is that it is not twice as long as it now is.

AMERICA.

The Cruise of the Neptune. By A. P. Low, B.Sc., F.R.G.S. Ottawa : Government Printing Bureau, 1906.

In the spring of 1903 the Canadian Government decided "to send a cruiser to patrol the waters of Hudson Bay and those adjacent to the eastern Arctic islands; also to aid in the establishment on the adjoining shores of permanent stations for the collecting of customs, the administration of justice, and the enforcement of law as in other parts of the Dominion"; and the exceedingly interesting volume now before us is the report of what was done in carrying out these objects. It is written by Mr. A. P. Low, the officer in charge, who, not content with a merely official report of his cruise from August 1903 to October 1904, has added several interesting chapters containing "a short historical account of earlier explorations and discoveries in north-eastern Arctic America; a geographical sketch of what is at present known of the inhabitants and geology of the unorganised north-eastern territories of the Dominion; short descriptions of the important whaling and sealing industries; and opinions as to the possible navigation of Hudson Strait and Hudson Bay." There are also valuable appendices giving "the meteorological observations taken on the voyage, interesting notes on the thickness and growth of the ice; also lists of the birds, plants, and fossils collected in these northern regions." The story of the cruise is written in the clear, frank, easy, businesslike way which we expect from a scientist who is also a sailor; and the interest never flags. It speaks well for the seamanship of the officers and crew of the *Neptune* that they cruised for some fourteen months amid the shoals and ice of Hudson Bay and met with no more serious mishap than the loss of the launch, which was wrecked near a place judiciously named Dangerous Point. The historical summary is very complete, beginning with the voyage of Sir Martin Frobisher in 1576 and ending with that of Sverdrup in the *Fram* in 1902. To the ethnologist the most interesting chapters will be those descriptive of the Eskimos, in which Mr. Low has brought together the results of former investigations and researches by missionaries, seamen, and scientists, and has supplemented them by his own observations. Within the compass of fifty pages the reader has presented to him an excellent compendium of what is known regarding the daily life, habits, customs, religion, etc., of these strange and rapidly-diminishing races. The description of the geology of the region has been judiciously compiled from reports by such competent authorities as Drs. Dawson, Bell, and Schei. A specially interesting chapter is devoted to the industry of whaling, from which we learn that although

the value of a large whale varies from £3000 to £4000, yet so few whales are now left that the chase is becoming unprofitable. This unusually attractive report is equipped with an excellent map, and is illustrated with some very good photographs, and we cordially recommend it to the perusal of our readers.

BOOKS RECEIVED.

The Land in the Mountains: Being an Account of the Past and Present of Tyrol, its People and its Castles. By W. A. BAILLIE-GROHMAN. With an Introduction by CHARLES LANDIS. Demy 8vo. Pp. xxxii + 288. Price 12s. 6d. net. London: Simpkin, Marshall, Hamilton, Kent and Co., 1907.

L'Aurore Australe. Par BIARD D'AUNET. Un volume in 16. Pp. 402. Prix 3 fr. 50. Paris: Librairie Plon Nourrit et Cie., 1907.

The Senior Geography. By A. J. HERBERTSON and F. D. HERBERTSON ("The Oxford Geographies," Vol. III.) Crown 8vo. Pp. viii + 363, with 117 Maps and Diagrams. Price 2s. 6d. Oxford: Clarendon Press, 1907.

Ancient Khotan: Detailed Report of Archaeological Explorations in Chinese Turkestan carried out and described under the Orders of H.M. Indian Government. By M. AUREL STEIN, I.E.S. Vol. I. Text, Vol. II. Illustrations. Royal Quarto. Pp. xxiv + 621. 119 Plates. Price £5, 5s. net. Oxford: Clarendon Press, 1907.

Voyages of the Elizabethan Seamen: Select Narratives from the "Principal Navigations" of Hakluyt. Edited by EDWARD J. PAYNE with additional notes by C. RAYMOND BEAZLEY. Illustrated. Cr. 8vo. Pp. lxxii + 415. Price 4s. 6d. net. Oxford: Clarendon Press, 1907.

Red Rubber: The Rubber Slave Trade on the Congo. By E. D. MOREL (popular edition). Cr. 8vo. Pp. xxxii + 241. Price 1s. net. London: T. Fisher Unwin, 1907.

Eiszeit und Urgeschichte des Menschen. Von HANS POHLIG. Cr. 8vo. Pp. viii + 141. Preis M. 1.25. Leipzig: Quelle und Meyer, 1907.

Grundzüge der Länderkunde. Von Dr. ALFRED HETTNER. Europe. I. Band. Demy 8vo. Pp. xvi + 737. Preis M. 16. Leipzig: Otto Spamer, 1907.

Le Lot, Padirac, Rocamadour, Lacave: Guide du Touriste du Naturaliste et de l'Archéologue. Par ARMAND VIRÉ. Pp. vii + 310. Prix fr. 4.50. Paris: Masson et Cie., 1907.

A Guide to Zermatt and the Matterhorn. By EDWARD WHYMPER. With 79 Illustrations and Maps. Pp. xv + 224. Eleventh Edition.

A Guide to Chamonix and the Range of Mont Blanc. By EDWARD WHYMPER. Pp. xiv + 206. Twelfth Edition. London: John Murray, 1907.

I Vulcani Attivi della Terra: Morfologia-Dinamismo-Prodotti-Distribuzione Geografica-Cause. Par G. MERCALLI. Demy 8vo. Pp. 422. Prezzo Lire 10. Milana: Ulrico Hoepli, 1907.

L'Or dans le Monde (Géologie-Extraction-Economie-Politique). Par L. de LAUNAY. Pp. xxi + 265. Prix fr. 3.50. Paris: Armand Colin, 1907.

Bradshaw's Through Routes to the Chief Cities of the World: A Comprehensive Handbook of Colonial and Foreign Travel. Edited by Prof. A. H. KEANE, LL.D., and STANLEY REED. Pp. xlvii + 653. Price 5s. net. London: H. Blacklock and Co., Ltd., 1907.

Sunshine and Sport in Florida and the West Indies. By F. G. AFLALO. With 47 Illustrations. Demy 8vo. Pp. xxv + 272. Price 16s. net. London: T. Werner Laurie, 1907.

Forty Years in the Argentine Republic. By ARTHUR E. SHAW. Cr. 8vo. Pp. 229. Price 2s. 6d. net. London: Elkin Mathews, 1907.

The Eastern Alps including the Bavarian Highlands, Tyrol, Salzburg, Upper and Lower Austria, Styria, Carinthia, and Carniola. Handbook for Travellers. By KARL BAEDER. Eleventh Edition. Pp. xxvi + 574. Price M. 8. Leipzig: Karl Baedeker, 1907.

New Canada and the New Canadians. By HOWARD ANGUS KENNEDY. Preface by LORD STRATHCONA. Coloured Illustrations. Cr. 8vo. Price 3s. 6d. London: Horace Marshall and Son, 1907.

Field-Path Rambles. By WALKER MILES. Pp. 208. Price 1s. London: E. Taylor and Son.

A Guide to the Great Zimbabwe Ruins. By R. N. HALL, F.R.G.S. Pp. 34. Price 1s. 6d. Cape Town, 1907.

Also the following Reports, etc.:—

Jaarverslag van den Topographischen Dienst in Nederlandsch-Indië over 1906. TWEDE JAARGANG. Pp. iii + 177. Batavia, 1907.

Handbook of the Australian States: A Guide for Emigrants. Pp. 94. London, 1907.

A Handbook of Cyprus. Compiled by Sir J. T. HUTCHINSON, M.A., and CLAUDE DELAVAL COBHAM, C.M.G. Cr. 8vo. Pp. xii + 132. Price 2s. 6d. net. London: Edward Stanford, 1907.

La Question Congolèse. Par ARISTIDE CORNOLDI. Pp. 63. Milano, 1907.

The Statesman's Year-Book: Statistical and Historical Annual of the States of the World, for the year 1907. Edited by J. SCOTT KELTIE, LL.D., with the assistance of I. P. A. RENWICK, M.A., LL.D. Forty-fourth Annual Publication. London, 1907. Price 10s. 6d. net.

The Prehistoric Gold Mines of Rhodesia. By R. N. HALL, F.R.G.S. Pp. 45. Grahamstown, S.A., 1907.

Mineral Resources of the United States, Year 1905. By DAVID T. DAY. Washington, 1906.

Third and Final Report of the Geological Survey of Natal and Zululand. By WILLIAM ANDERSON, F.R.S.E., F.G.S. London, 1907.

Commercial Gazetteer of Great Britain and Ireland. Royal 8vo. Pp. 648. Price 3s. 6d. net. Edinburgh: Wm. Macdonald and Co., Ltd., 1907.

Muzaffarpur. By I. S. S. O'MALLEY. (Bengal District Gazetteers.) Calcutta, 1907.

Transpacific Longitudes between Canada and Australia and New Zealand executed during the years 1903-1904. By OTTO KLOTZ, LL.D., F.R.A.S. Ottawa, 1907.

Assam District Gazetteers. Vol. x. *The Khasi and Jaintia Hills.* By B. C. ALLEN, C.S. Allahabad, 1906.

Madras District Gazetteers: Vizagapatam. By W. FRANCIS, I.C.S. Madras, 1907.

Natal Government Railways: Report of the General Manager of Railways for the Year 1906. Durban, 1907.

Notice Historique sur La Guyane Française. Par HENRY RICHARD. Pp. xvi. Paris, 1906.

Publishers forwarding books for review will greatly oblige by marking the price in clear figures, especially in the case of foreign books.

THE SCOTTISH GEOGRAPHICAL MAGAZINE.

NOTES AND OBSERVATIONS ON AN EXPEDITION IN THE WESTERN CAPE COLONY.

By Lieut. J. A. G. ELLIOT.

*(With Map and Illustrations.)*¹

THERE are so many interesting parts of the globe that it seems scarcely worth while to attempt to describe a country that is little better than a desert, yet such is the Karroo—that great expanse stretching from the Rogge Veld, Komsberg, Nieuwveld, and Sneeuwberg Ranges to the Orange River, which forms the boundary between Cape Colony on the one side and German South-West Africa, Bechuanaland, Griqualand, and the Orange River Colony on the other. It is, however, only with regard to the north-west portion of this that I have any personal knowledge.

No exploration of a scientific nature has, I believe, ever been made through this country unless perhaps that under Livingstone who, on his way to the Zambesi, is said to have passed through the farm of Schietfontein, the site of the present town of Carnarvon. Since his day considerable changes have no doubt taken place, more especially in regard to the quantity of animal life,² the lack of which is most remarkable. This is simply due to unrestricted shooting on the part of the Børs, and especially of the “vor-trekkers,”³ who, instead of limiting their exertions to reducing the natives, and killing such animals as destroyed their stock, carried death to every living thing that crossed their path. Consequently nothing but an occasional troop of ostriches

¹ All the illustrations of this article are from original photographs taken by myself. Fig. 4 unfortunately gives an inadequate representation of the true height of the mountains.

² Insect life is unlimited, including varieties of beetles, ants, and spiders; there are also numbers of lizards and locusts.

³ “Vor-trekker”—Dutch word meaning leader or pioneer.

breaks the monotony of the wilderness, save when a rain-storm has brought after it the erratic springbok, or equally erratic N'maquois partridge, or locusts.

An expeditionary party,¹ commanded by Captain A., was despatched to Victoria West in October 1905 with the object of fixing survey points (1) between that place and Prieska, and (2) between two lines of the Geodetic survey, running the one for some distance along lat. 31° South, in the vicinity of the upper Zak River, and the other along the Orange River in lat. 28½° and 29° South, in the neighbourhood of Upington. (See Map, p. 402.)

On the completion of the first part of this work we found ourselves at Carnarvon, where, the heat of midsummer being over, at an elevation of some 4000 feet the temperature was delightful.

In spite of a rest and the recuperating effect of the cool air, our animals had hardly recovered from the killing heat of the low veld from which we had returned, before it was necessary to take the second portion of the work in hand.

We trekked away westwards to places called Brandvlei and Tontelboschkolk, but after six or eight weeks found it necessary to return to Carnarvon to get supplies, forage, mails, and general outfit. Thus this part of our journey was divided into two distinct trips, to the latter and more interesting of which I propose limiting myself here.

As before, our route lay westward, through and along the Karree Berg, the western part of which forms a portion of the most important watershed in that district. This watershed may be said to commence at Tulbagh, near the Zak River valley, and to run from there to Pot Loer in the Karree Berg, and along that range to within ten miles of Carnarvon, then a little southward to the Beyersberg and to Paardeberg, and so on to Biesjesdam, thence gradually dying away to the north-east. It measures nearly 150 miles in length and runs practically due east and west along lat. 31° S.

After all, it is but one of the many watersheds to the north of the Drakensberg, forming the chief geographical features of the country. Water on the south side of this range drains away to the Brak River to the east and to the Zak River to the west.

In March, shortly before we left Carnarvon, there had been a good rainfall in the neighbourhood, the first recorded for three years. Therefore it is needless to say that up to this time everything had been dried up; most of the veld bushes had died, and water at the farms had become so scarce that travellers were obliged to pay for it. Further west in the Fraserburg district there had still been no rain and the farmers were leaving their homes and were following their sheep which, months before, had been sent away to Hopetown, Prieska, and the Orange River Colony—in fact anywhere where water and grazing were to be had. The roads were often littered with carcasses, and it was

¹ The party consisted of Captain A., myself, and four natives. We were fitted out with a light L.P. waggon, a small Scotch cart, fifteen donkeys, four mules, and four horses. These numbers were much reduced before the end of the expedition.

not uncommon to find a Boer¹ who once had been the proud possessor of, say, 3000 head of sheep having now no more than 300. Providentially the March rains, although confined to the country in the vicinity of Carnarvon and that to the south-east of it, saved some at any rate from utter ruin.

Thus, when we started off, the veld was showing signs of recovery, and those bushes that were not absolutely dead were getting green, and a few blades of grass were showing themselves here and there. But this is not a grass-growing district. The veld is covered with scrub or heath, of which a certain kind is unsurpassed for fattening sheep, and makes the Karroo famous for small stock farming. If only two inches



FIG. 1.—Typical dry river-bed.

of rain could be counted upon yearly it would be one of the best sheep-raising countries in the world.

To any one who has not seen the Karroo it is difficult to give a realistic description of it; its immensity, its monotony, the preponderance here of rocks, there of gravel or of sand, as the case may be, the peculiar vegetation which changes from a luxurious carpet of gorgeous many-coloured flowers of untold varieties to a black dead waste as rain or drought has blessed or cursed the land—these are the points which are most striking to a stranger. The majority of travellers who have seen the Karroo know it from the railway train, and grumble at the weary twenty-four hours from Matjesfontein to Orange River Station or Norvals Pont. These people have little idea of the Karroo

¹ "Boer" is a Dutch word meaning farmer.

as it really is; for to know and to appreciate it a man must have lived there, have seen the works of Nature, and have mixed with the inhabitants. Only by so doing can he form opinions that are of any value.

As mentioned above, our road ran through the Karree Berg, which takes the form of a rough, irregular-shaped plateau. Winding our way up from Carnarvon we crossed the main ridge and proceeded rapidly down a glen past Konka, whence we emerged on sandy open veld that gradually fell away to a small farm situated some miles ahead on a dried-up spruit.

It may be as well here to say that all rivers, spruits, and water-courses mentioned in this paper are absolutely dry unless special note



FIG. 2.—Zwartfontein.

is made to the contrary. There is never any running water except after rain, and farmers dig holes or sink shallow wells in order to get a sufficient supply for domestic purposes and for a few head of sheep.

From the spruit the road gradually rose again for about two and a half miles, and then we suddenly found ourselves at the top of Meintjeskloof—a narrow glen—down which we went. It is so hemmed in by hills on each side that for part of the way the road is carried along the bed of the spruit, which, owing to the recent rains, had lately come down in a torrent, torn up all semblance of a track, and scattered rocks in wild profusion everywhere. It was almost impassable for transport.

From the foot of Meintjeskloof we again found ourselves on a sandy stretch of veld; but only for about three-quarters of a mile, when the

road turns at right angles to the left up another glen, which in due course brought us up to a flat plateau only about 100 feet lower than the top of the surrounding hills. But here a shock was awaiting us. For the last half mile the bushes had been getting poorer and less green, and on reaching the plain it was only too obvious that not a drop of rain had fallen, for a desolate stretch of black sticks and heavy sand lay before us!

Previous experience told us what this would mean, and we did not relish the thought.

In the far distance, at the foot of one of the last spurs of the Karree



FIG. 3.—Dutch family at Zwartfontein.

Berg, the farm of Zwartfontein could be distinguished (see Fig. 2), where in due course we arrived and outspanned for several hours.

From the ridge behind the house we obtained a very extensive view to the north-west in the direction of Boterleegte and the Twee Melk Berg. Seeing the low-lying disposition of the ground ahead of us, we gathered that the condition of the road would be sandy and that travelling would be consequently slow, so we decided to benefit by a full moon and make a night trek into this wilderness. Nothing disturbed the stillness of the night but the howling of the jackals.¹

Our road lay by Zout Rivier, and so on to the Twee Melk Berg—a mountain named from its resemblance to a woman's breasts—of which the higher peak was our destination. It rises abruptly on the north

¹ Jackals, tiger-cat, and snakes are common though not frequently seen. Rooicat (lynx) and tiger (leopard) are rare. Baboons are common in the hills in certain districts.

side about 1000 feet above the surrounding plain, and this makes it much more noticeable than Port Loer, which is in fact considerably higher and has no equal for many miles around. The latter rises to a height of 4789 feet above sea-level.

From Pot Loer the main ridge of hills gradually falls away to the west. They are still called the Karree Berg, and extend as far as Rietpoort, whence they are connected by rantjes and small detached kopjes with the Rhenosterberg—a flat but rough plateau, jutting abruptly northward into the plain. At Dassies Kloof there is a rapid fall in the general level of the country—apparently a “steppe” between



FIG. 4.—The Jakhals Toren and distant Tulbagh Mountains.

two plateaus—the easternmost being several hundred feet above the other.

There is a break of five or six miles of open country between the Rhenosterberg and the Jakhals Toren—a Toren being a hill of perfectly symmetrical conical form terminating in a “krantz,”¹ *i.e.* a low precipitous cliff round the summit of a hill. In this instance the krantz is about fifty feet in height (Fig 4).

Hills of this type are by no means rare. Amongst the Tulbagh Mountains there are several very perfect, though smaller ones. The Pramberg² and Aasvogel Kop in the district of Victoria West are hills of a similar nature. On a still larger scale, but of much the same kind,

¹ “Krantz”—literal meaning is crown.

² “Pram”—Dutch word for breast.

are many of the detached kopjes in the Britstown district, as an example of which Leebs Kop¹ stands pre-eminent.

The rock forming the top of these hills is dolerite, whilst the sides seem to be of a broken shale.

A flat stretch of three-quarters of a mile separates the Jakhals Toren from the nearest of the Tulbagh Mountains, near the westernmost point of which is Tulbagh itself. These hills rise about 1000 feet above the plain.

Like the Twee Melk Berg, and for that matter like all hills south of the Orange River, the Tulbagh Mountains are steeper on the north side than on the south, in places being even precipitous.

What is very striking is the remarkable resemblance these hills bear to a seagirt coast—the sea in this case being represented by the far stretching plain, out of which the hills protrude so conspicuously. The horizontal and parallel ridges running along the sides of many of the hills, more especially in the mountainous country of north-western Natal, are very conspicuous.

From Tulbagh the country bears a very featureless aspect, the only defined hills being Spion Berg to the west, the Calvinia Mountains and Fraserburg Mountains to the south-west and south respectively, and our old friends Pot Loer and the Twee Melk Berg to the east; to the north nothing strikes the eye as it scans the low undulating plain except a few red sand-dunes, and the ridge of low-lying hills running east and west of Leeuwkuils Poort, which is the only distinct feature between ourselves and the flat skyline about fifty miles distant. The general slope of the country is both northwards and westwards, though in the latter direction only as far as the Zak River. Beyond Leeuwkuils Poort and the ridge of hills there, comes a line of “vloers,” after which the ground begins rising into the “bult”² beyond, but this does not attain the height of the Tulbagh Mountains.

The “vloers” are one of the most remarkable features of the country, and conform to the general trend of the hills in so far that they lie between them, and extend like them east and west. A “vloer,” which is a Dutch word meaning “floor,” is an absolutely level flat of caked mud destitute as a rule of all vegetation. When there is rain, however, it becomes too heavy for wheel traffic and remains so till the water has evaporated or drained away, sometimes leaving a coating of coarse salt. On Commissioners Pan, for instance, as well as at places more conveniently situated near Kimberley, syndicates have been formed for collecting the salt, and no doubt, if the country were opened up, this would prove a good business.

In this part of South Africa a pan does not essentially differ from a vloer, and often the word is used synonymously. But strictly speaking, I believe it is the crater of an extinct volcano, varying in size from thirty

¹ The Lion's Head at Cape Town also seems to be a somewhat similar but less remarkable feature of the same kind.

² “Bult”—high, featureless, undulating plateau, from one rise of which it is impossible to see further than to the top of the next, and so on.

yards to two or more miles in diameter. The most typical are found on the tops of hills where they are usually elliptical and of considerable depth, *i.e.* from 50 to 100 feet below the surface of the surrounding ground. The bottom of a pan is absolutely level, and often consists of a blue soil entirely different from that round about. Such at any rate is the case in the Transvaal and Orange River Colony. A vloer differs from a pan inasmuch as it may be of irregular shape and looks like the bed of a dried-up lake. The vloer, too, usually has an outlet, whilst the pan has not. Both are alike, however, in being dead level.

After finishing our observations on the Twee Melk Berg, we trekked off through deady dull country to Klip Kolk, on the main road between Carnarvon and Brandvlei. We were more than delighted to find a large dam full of water at that place, good rains having recently fallen on part of the farm and also in the direction of Van Wyks Vlei. The farmer was rejoicing too, for he had now enough water to last him for at least eighteen months. We secured from him a few fresh vegetables, mealies, sponspecs,¹ and meat, which were all the more agreeable after the ordinary fare of tinned meat and biscuit.

Our work now carried us westward again, and on account of the heat—for we had now fallen a good many hundred feet since leaving Carnarvon—we made a night trek to Yzerdoorns, the latter part of the way being through practically an uninterrupted series of vloers.

The rising sun, glistening across desolate flats of mud, together with the fleeting figure of my companion, that might have been taken for a silhouette of Don Q. riding over the waste, made a picture that is not easily forgotten.

From here we struck north to Molmans farm at Bros Pan, where we encamped at a convenient distance from the house. Molman, as his name suggests, is of Turkish origin, and if report is true he has not entirely lost the nature of his forefathers. On this farm petroleum has been discovered, and will probably be worked before many years. There is no doubt that petroleum stone is found very extensively, but whether the oil has been exhausted by natural phenomena or not is a matter for experts to decide. This stone is frequently to be found in low-lying ground, but it does not become exposed to view unless at the foot of a kopje, where there has been some natural disturbance. I have, however, noticed it on the bult on the same farm, but this is very exceptional. Generally all the bults in this part of South Africa are formed of gravel and seem to suggest possibilities of considerable interest to the geologist.

From Bros Pan we moved out on to the bult, which runs approximately east and west from near Twee Rivier to Hartogs Kloof. Though the Hartebeest River breaks through at this last-mentioned place, the general hill feature is carried on in a north-easterly direction by the Konka Berg.

As it proved impossible to fix and mark points either in the neighbourhood of Bros Pan or on the adjoining farm of Abiqua Puts, it was decided to separate—one of us travelling by Hartogs Kloof, and triangu-

¹ "Sponspecs"—kind of sweet melon.

lating on the hills there, including Riet Kop and the Boschmansberg, whilst the other went by Brandvlei and down the Zak valley to Blokzyn-kolk, where we intended to meet.

This having been definitely arranged, I trekked into Brandvlei—one of those heaven-forsaken spots on the border of the almost unknown country of Bushmansland—where I raised such forage and supplies as were available. With no apparent means of existence, it is little more than extraordinary how a population consisting merely of about a dozen Dutch and Jewish families, together with, say, a hundred and fifty natives, can exist at all. The church, a double-storied building, is the only edifice of any pretensions, and looks much out of place amongst the sundried brick hovels that surround it. The spot is not an enlivening one, and recollections of the difficulties we had experienced in getting water on a former occasion made me all the more desirous of curtailing my visit. The particulars are as follows:—

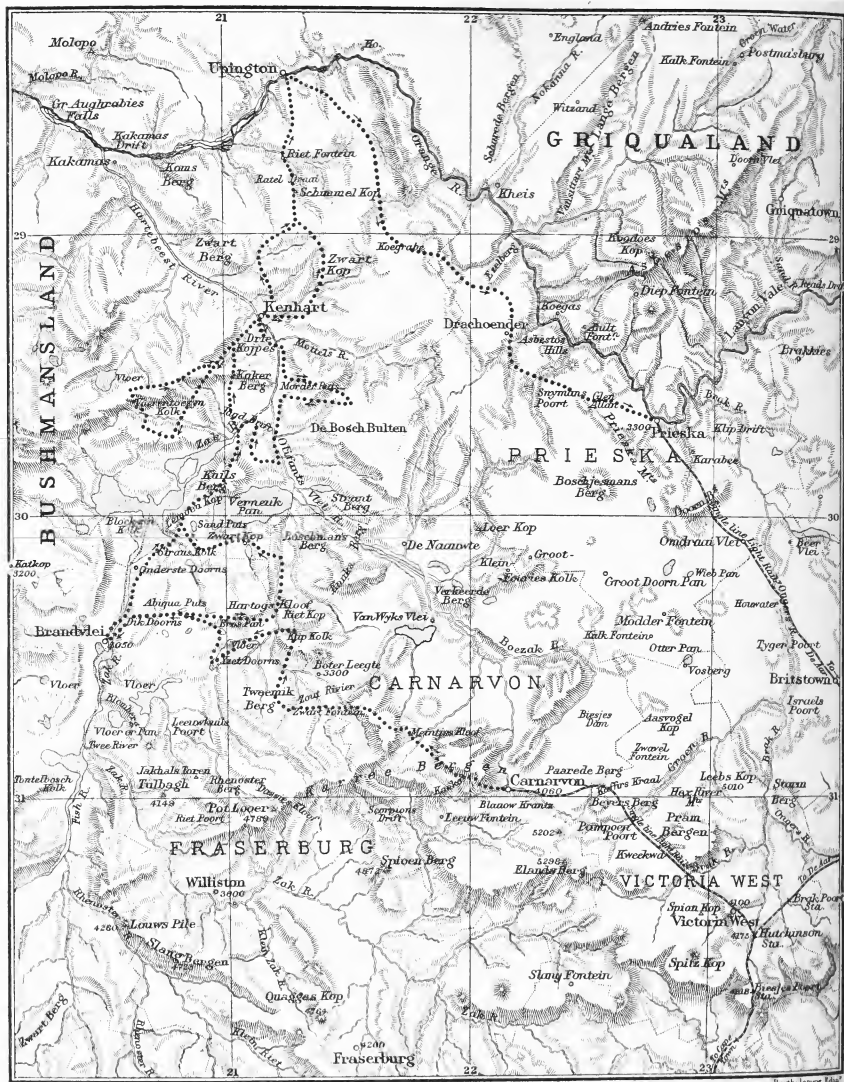
It had happened that after a good morning's work we arrived at a farm where we were told that we should find no water short of the Zak River, nearly thirty miles further on. We started in the evening, and after a few miles came to a large vloer, which we crossed at the narrowest part, but which even there was nearly three miles broad. Then we wound our way for many a long mile up the bult, near the top of which we outspanned for the night. Here one of the horses got sand colic, but a good dose of medicine put him to rights—at least sufficiently so to allow of his being led behind the waggon the next day. Although we started before light, we had nevertheless underrated the time required, for what with the heavy roads, the great heat soon after sunrise, and the animals getting tired and thirsty, it was not until midday in the full blaze of a semi-tropical sun that we struck the Zak River, which, like all others, was quite dry! Having in vain explored right and left in the hopes of finding a waterhole, we decided to push on a few miles to the village of Brandvlei. But further disappointment was awaiting us; for immediately on arrival we drove the animals down to the village well, merely to find that the water was so bitter and salt that only the donkeys would touch it. Needless to say it was too bad for the inhabitants, who we found carted their water from a certain place in the river-bed three miles further on. There was no choice but to go on there and to encamp near to it.

Now, at the time of my second visit I remembered these difficulties, and there having been no rain in the country I expected to be in a worse plight than before; but fortunately the river, which rises in the Drakensberg, where the rainfall is often very heavy, had come down a short time previously, and though dry again now, there was enough water in a small dam at Dik Doorns for our wants.

Owing to the prolonged drought of some five years' standing a great number of farmers had been compelled to leave the district and go elsewhere, thus greatly adding to our difficulties in finding our way. These were still further increased by our "boys"¹ being strangers to this part

¹ "Boy"—Colonial word for native servant.

LIEUT. ELLIOT'S EXPEDITION IN N.W. CAPE COLONY.



Lieut. Elliot's Route shown thus

English Miles
0 10 20 30 40 50 60

of South Africa, and by our having no guide, so that we were dependent upon our own limited knowledge of Cape Dutch for any information we required: this was very unreliable.

The map on page 402 shows that the Zak River, together with the Fish River, and other minor tributaries, drain the greater portion of the Fraserburg district. Rising as many of them do in the Rogge Veld, Komsberg, and Nieuwveld mountains, where there is a considerable rainfall, they enable the farmers living along practically the whole length of the Zak River, to count on its flowing several times in the year.

From Brandvlei the river winds through an open valley four to five miles in width bounded by low hills. Here the river-bed is about eighteen feet in depth and seventy yards in breadth, and continues so past Onderste Doorns, where a few clumps of thorn along the banks break the usual bleakness of the scenery.

There is no special geographical feature before coming to the huge vleis into which the Zak River may be said to debouch, and in the centre of which are the farmhouses of Blok-zyn-kolk.

On arrival at the southern extremity at a place called Straus Kolk, I found the river was coming down, the vleis inundated, and all roads into Blok-zyn-kolk impassable, for heavy transport at any rate, except one from the south-west, which being on the opposite side of the river was of course of no use to me as I could not get there.

These "vleis"—improperly so called, as the strict meaning of the word is "valley"—are identical with the usual type of vloer already described, except that instead of being a barren stretch of caked mud, the soil is extremely fertile and highly productive where under cultivation.

This difference appears to be due to the rich alluvial mud deposited by the Zak River rather than to any other cause. All sides are surrounded by featureless hills, which gradually merge into the "bult" proper, the Lemoen Kop and Klein Lemoen Kop being the only exceptions.

At Blok-zyn-kolk dams of considerable size store up the waters of the Zak, and a great deal of wheat is raised there. Although an average yield of seventy to an hundredfold is obtained by the farmers, the lack of a near market is too insurmountable a difficulty for the unenterprising Dutchmen.

Owing chiefly to natural causes, but also no doubt partly to the dams, no surface water escapes below the Lemoen Kop, and the dry valley of the Zak winds along for thirty miles or so before meeting the Hartbeest River, which like all others flows only at times of rain. Of course a certain amount of water filters down the Zak valley from the large vleis, as well as drains in on either side from the neighbouring hills, keeping the grass fresh and green and filling up wells.

But let us now glance at the map, and imagine ourselves standing on the Lemoen Kop looking north-eastwards. Straight in front is the Kuilsberg, connected with us by a neck of undulating high land several hundred feet above the valley of the Zak on our left, and similarly above Verneuk Pan on our right, whilst almost at our feet upon the neck lies the vloer at Sand Puts. The pan, which has an extent of about twenty

miles, might more appropriately be termed a vloer by reason of its resemblance to a huge dry lake, and of its having an outlet in the Hartebeest River at its eastern extremity. Owing to its great size the "ophazel" or mirage is exceptionally delusive, and it is due to this that the Dutch gave it the name of Verneuk or Bamboozle Pan.

According to the legend, a certain Boer who was riding over it, got so puzzled by the mirage, that, after travelling for several hours, he had to admit himself lost. Tired with his ride and parched with thirst, he off-saddled, and, according to the custom of the country, let his horse loose. The animal wandered a short distance, when suddenly the wayfarer noticed, much to his surprise, a second horse exactly similar to his own. To be brief, the real one disappeared in search of water or food, and the Boer was left to pursue the phantom. A few months later some farmers, returning from a successful hunt after springbok, came across the bleaching remains of the lost Jappie. Of his identity there was no doubt, and friends had no hesitation in guessing the cause of his death.

We may here notice that the alternate lines of hill and vloer which succeed each other in the country we have been traversing, conform approximately to one general direction, east and west.

In the first place there is the main watershed of the Karree Berg, including Pot Loer and Tulbagh, then a series of vloers and low ground extending from the Blomberg near the Zak River to Yzerdoorn, Boeterleegte, and Van Wyk's Vlei; these are succeeded by the bult, to the south-east and east of Brandvlei running to Hartogs Kloof, and continued from there by the Konka Berg. Next come the large vleis round Blok-zyn-kolk, the Sand Puts vloer, and Verneuk Pan. These main features seem to be carried on to the east of the Hartebeest River. Immediately to the north of the western portion of Verneuk Pan is the Kuilsberg, from which high ground extends right away eastwards to the Kyle or Bosch Bulten—an exceptionally large undulating gravel plateau, rising to considerable elevation and quite waterless. North of the Kuilsberg the dry valley of the Zak River, running in a north-easterly direction, emphasises the height of the bult on the opposite side; and this is in fact the highest ground between the Brandvlei-Konkaberg bult and the Orange River. It extends from some indefinite point in Bushmansland to the Hartebeest River, dying away in the Kokerberg south of Kenhard. To the north of this the country falls much more rapidly and with no trace of the general features that have so far predominated. Very marked, isolated, and often grotesquely shaped hills now make their appearance along the valleys of the Hartebeest and Orange rivers. The tops of these kopjes correspond approximately with the height of the bult, and thus as the level of the ground gradually falls away to the rivers the more prominent do they become. Owing to their great steepness and to the abruptness with which their sides descend—there being no gradual sloping away near the base—the impression is given of their being stuck on to the earth rather than forming an integral part of it.

A word remains to be said regarding the Prieska Mountains; these stretch from the neighbourhood of Grootdoornbergfontein south of

Prieska in a north-westerly direction to the Orange River, and then continue along it in a broken line of ridges. These hills are of geological rather than of geographical interest, abounding in asbestos and crysolite.

To return to our movements, it will be remembered that on separating at Abigua Puts we had arranged to meet at Blok-zyn-kolk; but now, owing to the flooded condition of the vleis, it was impossible to carry out the plan. Under these circumstances I decided to outspan at a place called Sand Puts, where A. turned up next day—by instinct, without knowing that it was impossible to get to Blok-zyn-kolk. After making observations from the Lemoen Kop we proceeded to the Kuilsberg and then on to the Kokerberg.

The character of the gravel on the bults and of the coarse sand¹ in the Zak River valley appeared to be of considerable interest. Quartz, felspar, and mica predominate in it, whilst zircon, green pebbles, garnets and other crystals are not uncommon in certain parts. In places extremely hard grey granite rocks protrude in the river bed and sometimes outcrops of pure white quartz are met with on the high ground. Copper exists north of the Kokerberg, and in the vicinity of Kenhard.

Driekopjes is the most prominent feature near by, and is made use of as a heliograph station by the police. Although it rises 800 to 1000 feet above the surrounding country, it is all the same insufficiently high to afford a view over the bult to the south of it, and was consequently of little use to us for work in that direction. The bult, too, was so flat as to necessitate several minor treks to the south-east, south, and south-west, before the work could be satisfactorily carried forward again.

Bad luck seemed to dog our steps at this time, for in attempting to fix points on the Bosch Bult we got nearly stranded on its wide waterless wastes, and on another occasion, owing to our "boys" mistaking their way when they had been sent on with the waggon, we underwent the affliction of tracking them for the greater portion of the night over rough and unknown roads before succeeding in catching them up.

Soon after this I trekked into Bushmansland, but the difficulty of getting water quite took away any pleasure in the trip. There, far beyond the touch of civilisation, the white man was to be seen in his crudest form, and it was interesting to observe to what state he had fallen. Broadly speaking, the Dutchman in South Africa bears some resemblance to the Scotsman. Both are loosely put together, big-boned and angular, but in his stature, which is usually not less than six feet, and in the oval shape of his head, the Dutchman differs from the bullet and square-headed people of North Britain. His complexion, too, is very dark, due partly to exposure to a semi-tropical sun, partly to a naturally sallow appearance, mostly observable amongst women and children; whilst dark hair and eyes are predominant throughout the race.

Whilst in most parts of South Africa there are only certain families—such as De Villiers—in which coloured blood can be distinguished, yet here in the back-country it is not only frequent but strongly marked.

¹ The colour of the sand is grey, tinged with pink, and it glitters a great deal.

The women are strong and strapping for their sex, and as matrons reach the most monstrous proportions imaginable. Good looks and figure from an English standpoint are usually wanting.

Maturing earlier than in England,¹ girls who have reached the age of sixteen or seventeen should be compared with those of three or four and twenty at home. For this reason marriage is contracted correspondingly early; it is also more easily entered into since there do not exist on the veld the same difficulties as in the midst of twentieth-century civilisation in the old country, for the needs of a newly wedded pair are of the simplest kind—not much more than a waggon, a tent, and a flock of



FIG. 5.—Voeren-toe-zyn-kolk (Bushmansland).

sheep and goats being requisite. When even these humble requirements are not to be had, the "bywoner system" has to be resorted to. It is a system common in South Africa, and practically amounts to an arrangement between owner and tenant. The former supplies his bywoner with a small house and a plot of land, whilst the latter in return gives a portion of his crops or the value of his labour in payment thereof.

In the Western Cape Colony it occurred to me that families were

¹ The fact of girls reaching puberty earlier in South Africa than in Europe does not appear to apply only to the Dutch, but also to the English. The age of twelve or thirteen is generally considered equivalent to that of sixteen or seventeen elsewhere, but cases at ten or eleven are not unknown. In short a girl who is not engaged to be married at twenty is usually considered quite an "old maid." It is noteworthy that children born of women under seventeen years of age seem often to die in infancy.

insufficiently split up, and that the bywoner system was not so general as in other parts of South Africa; or at any rate it existed in a modified form, the bywoners instead of being strangers being near relatives of the proprietor. It is not uncommon to find quite a community of the same kindred living together. The grandfather—who as likely as not was the first settler—occupies the best house, whilst close by are his sons in huts or house-tents with their respective families. Uncles, aunts, and cousins dwell at the adjoining farms—in short, there are blood relations all round. The Boer has no ambition, or if he has any, it lies in the direction of owning land.¹ If he can raise a few sheep on the part apportioned to him, has a wife to keep his hovel clean and to cook for him, and a sufficiently large family to tend his flocks and do the farm work, he is content.

This lack of hope and ambition is not calculated to improve the race. There being no inducement and also no necessity for the young Boer to leave the locality in which he was born, marriage is almost necessarily confined to persons more or less nearly related to each other. Incest is not uncommon. Consequently it is not surprising that the number of persons of ill-developed or deranged mental capacities is large, but they are not of a dangerous or wild disposition. Whether the percentage is greater than that in England it is impossible for me to judge, more especially as at home private or public funds are available for procuring special accommodation, and this is well known to be greatly deficient in the Colony.

I have heard stated on excellent authority that a tendency to hypochondria exists, and that this is probably due to in-breeding, but speaking from personal experience I should not say that the Dutch are disposed to melancholy, but, on the contrary, lead happier and more contented lives than mankind generally. Still, as my informants were medical men, they were much better able to learn about the innermost thoughts and lives of these people than a passing stranger like myself. That a Boer is very despondent in sickness is quite undeniable—so is a native—but it by no means follows that they are so when in health.

Ignorance, and want of common sense in medical matters, together with a half-belief that sickness is sent direct by the hand of God in punishment for some offence, and should not for that reason be interfered with, possibly in some degree accounts for this dejection. One is reminded of the old rhyme—

“When the devil was ill, the devil a saint would be;
When the devil was well, the devil a saint was he.”

This applies truly to many a Dutch farmer, who sends for a doctor quickly enough if he should himself be indisposed, but would not dream of doing so for his wife or child till death is imminent. Doubtless he

¹ On the death of a Dutch farmer the land is equally divided amongst the sons—the eldest succeeding to the house and probably to the most valuable portion of the farm with it. At present, however, it is not uncommon to find many Boers owning 100,000 to 200,000 morgen, *i.e.* 202,000 to 404,000 acres.

does not hold them in that degree of affection which one would expect between persons of such near ties, for to him they are little better than chattels. "Surely," he reasons to himself, "if my big ugly vrou has committed some ill-doing by reason of which she is in the eyes of the Almighty no longer fit to dwell on earth, surely it is not for me, a humble and oprecht servant of the Lord, to interfere with His works, but rather to worship and give thanks for His goodness and bounty in supplying a choice of more than one 'mooi meisje' in the district, who I know will jump at the chance of becoming the wife of a great land-owner like myself. As for the child, well—he will hardly be missed out of a family of eighteen."¹

In the Transvaal and Orange River Colony the farmers are better educated, and possess a knowledge of English and of the world which would be hard to find in the inhabitant of the Karroo.²

Credulity follows in the steps of ignorance, and no portion of South Africa lends itself more aptly than this as a happy hunting-ground for quacks.

Towards preservation of health the Boer takes no measures. The houses impress one with their superficial cleanliness indoors, and their dirtiness out of doors, even up to the door-step. The beds, too, which are sufficiently broad to accommodate several persons, are infested with thousands of fleas and bugs—a circumstance that is not surprising considering that neither men nor women wash themselves sufficiently. It is due to dirt and careless sanitation that diphtheria is so common a cause of death amongst children, sometimes taking the form of an epidemic and sweeping right through communities.

Leprosy is not uncommon in the outlying farms amongst both the white and coloured population; but when the disease is sufficiently advanced to attract attention the individual is sent to Robben Island.

There are other causes habitual to a Boer's mode of life that must affect his health³ and physique, but these can only be briefly touched upon here:—*Inter alia* the growing ignorance of women in matters relating to child-birth and to the rearing of their offspring, the exclusion of fresh air from bedrooms, eating undue quantities of meat in proportion to other food,⁴ drinking bad coffee all day long, and smoking on an average one pound of tobacco per week.

There can be little doubt that environment or local surroundings have great influence upon men—individually in shaping their character, opinions, and lives; collectively, in creating the constitution, policy, and history of nations. So that in considering the characteristics of the inhabitants of the Karroo and their customs it is essential to call to mind the circumstances which have moulded them into what they are.

History records the landing of the Dutch at the Cape⁵ in the year

¹ Very large families are the rule. I noticed once an inscription on a tombstone recording that a woman had given birth to twenty-eight children.

² Difference in the language as spoken in the Karroo is marked.

³ Indigestion and highly strung nervous systems are very general.

⁴ This refers only to the Karroo and other sheep-rearing districts.

⁵ Discovered by Vasco da Gama in 1497.

1650, the subsequent native wars, and their gradual but slow occupation of the country which we have been describing.

The primitive manner of living and simplicity in thought and action are remarkable; their world is so small, and offers so little stimulus to the imagination, that their ideas have no opportunity of expanding, being confined to matters of actual necessity and of everyday life, except in regard to those matters connected with religion and with the awe-inspiring mysteries of nature.

The man concerns himself with only his sheep, the condition of the veld, and the prospects of rain; the woman thinks but of her household duties, and counts up the number of days to the next "Nachtmaal." This is a semi-religious festival held usually two or three times a year, somewhat corresponding to the former fast day in the Church of Scotland. It is an occasion when the people for miles and miles around trek in to the dorp in their best clothes, and give themselves up to pleasure. Every house in the place is overcrowded, and many have to rest content with the shelter of tents or waggons. Dancing—their one great social enjoyment—is freely indulged in, but the excitement, together with a very low general standard of morality, usually leads to a good deal of loose intercourse.

In this, as in all things, the Boer is very primitive and totally lacking in sense of delicacy. The broadest remarks are passed at wedding feasts, whilst at all times looseness of conversation between men and women is to be observed, often in the presence of quite young girls.

The shops or stores as they are usually called, do a great deal of business at nachtmaal, when the Boer thinks himself justified in laying in a small stock of delicacies, and in buying things that may take his fancy. One of his little peculiarities—as any back-country storekeeper will admit—is his inability to resist annexing any little thing that may by chance be lying on the counter. If the shopman is sharp enough to notice what has happened, it is the etiquette to say nothing, but to include the value of the article in the bill of purchases; whilst the Boer, on the other hand, as he was not 'cute enough to avoid detection, pays up quite willingly.

The condition of a back-country home depends much on the owner's wealth or poverty, and on the supply of water available. In the case of well-to-do people a good house is erected made of sun-dried bricks and covered with white plaster; but humble individuals have to content themselves with a poorer class of building, mud-hovels, rond-davels, or tents.

In a good dwelling the main walls are from two to three feet in thickness, fitted with lattice windows and doors. Partitions, however, are often no more than the width of a single brick, and sometimes in small houses a curtain answers the purpose.

All houses except mud-hovels and rond-davels are built on practically the same plan. The main door opens direct into a central parlour or living room, off which there is a bedroom on each side forming the total accommodation. Wealthy farmers, however, obtain more by adding a

room opposite the entrance, and then either increase the size of the bedrooms, or add a small reception-room on one side and a kind of scullery on the other. With the extra wealthy more rooms still are provided, accessible from a covered "stoep"¹ running the length of the house.

What is particularly striking is that there are no provisions whatever for privacy; passages are unknown, and access to rooms is obtained direct from one to the other. There are no means of bathing, sometimes not even for washing; a single basin and jug not infrequently doing duty for a whole family.

The kitchen is usually a very primitive concern and out of doors. It consists merely of an oven made of sun-dried brick and a conveniently raised dresser of like material, suitable for making a fire on, cutting up meat, etc., and is surrounded by a loosely piled fence of veld-bush, sufficiently high to keep off the wind. The oven and fireplace are neatly coated with a mixture of ant-heap and dung, which forms a hard smooth surface when dry. This mixture is also used frequently to cement the floors of houses; it is clean and cool.

The very poorest Boer lives in a yet ruder kind of dwelling than that already described; sometimes in nothing better than a shelter thatched with grass, sometimes in a *rond-davel*, and sometimes in nothing at all.

A *rond-davel* is a circular-shaped building of stone, say twelve to fifteen feet in diameter, with a conelike roof, made by each successive stone overlapping the one immediately beneath it, and closed by a large flat slab on top. Chinks are filled with mud, and the whole, both inside and out, is cemented over with the usual compound of ant-heap and dung. From the accompanying photograph (Fig. 6), it will be observed that certain stones are left protruding on the outside at regular intervals, but with what object it is difficult to say, unless as a strange form of decoration. These *rond-davels* appear originally to have been used as *kraals*² by native chiefs.

Close to the farmhouses and rather to the back of them are the sheep and cattle pens, into which stock are driven at night. The walls are built of stone or of slabs of hardened "mess"³ cut from an adjoining *kraal*. Thus the walls supply a plentiful reserve of fuel! It gives out a peculiar odour rather like peat, for "mess" makes a good smouldering fire, and is practically the only kind of combustible in the country.

Near by, also, is the well from which water is obtained in a variety of ways. Should it be deep, *i.e.* from eighteen to thirty feet, a bucket, rope, and roller are sometimes used, or else a donkey is harnessed to a beam of wood and trotted round and round, setting a series of small iron buckets in motion which empty the water into a trough. The better-off farmers go in for wind pumps of the latest manufacture.

¹ The nearest word expressing the meaning of "stoep" in English is verandah, but it need not necessarily be covered, and very often is not so in this part of South Africa.

² *Kraal* means Kaffir hut or sheep or cattle fold.

³ "Mess"—Dutch word for cow dung.

But at the poorer farms, of course, nothing nearly so grand is to be found. There the wells are usually not more than 10 to 15 feet in depth, the mouth of which is half covered with planks, on which one has to stand in order to lower a pail. A good deal of skill is required to fill it, and to bring it to the top again without falling in oneself. It is not uncommon to find at the brink of a well a tall forked stake supporting a cross-piece kept in place by reims,¹ so tied as to allow it to swing. On the one end is fixed a rope and bucket, and on the other a heavy rock, the weight of which is sufficient to raise a pailful of water. The latter is always more or less brackish, sometimes being extremely bitter

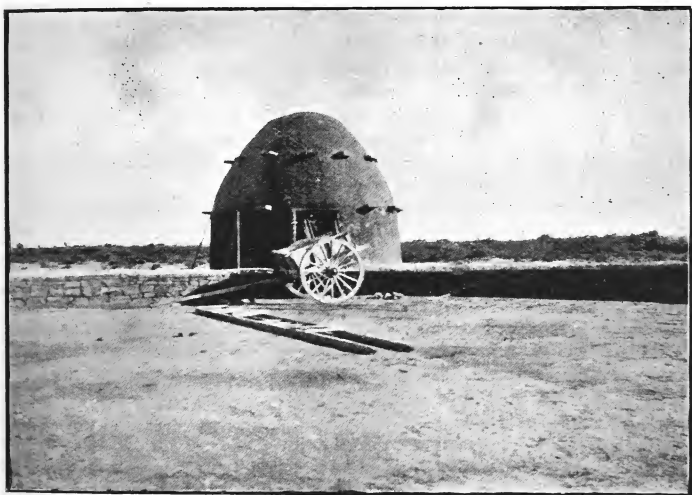


FIG. 6.—A Rond-davel, with threshing-floor in foreground.

and undrinkable. Owing to its scarcity in certain parts, permanent dwellings are not possible; and consequently, since the people are continually on the move, they find it convenient to live in tents, or, what is more general, merely in covered waggons. After good rains, hundreds trek into the heart of Bushmansland with their flocks and families and lead a nomadic existence there, encamping by the side of vleis and pans, till water gives out and they are driven back again.

At permanent homes there is usually a very small garden in which mealies, pumpkins, water-melons, sponspes, and vines are grown. Fig-trees do admirably and are decidedly common, whilst orange and apple trees are to be seen in the gardens of the more progressive farmers—for we must remember that they look upon their gardens as a means of getting luxuries, not necessities.

¹ "Reims," strips of cured hide.

A Boer's ordinary fare consists of mutton, bread, eggs, and goat's milk. Coffee and sugar are the only provisions bought for regular consumption, but sweets become a large item when there is ready money; for a Dutchman's, and more particularly a Dutchwoman's fondness for "laekers" is as great as that of the Scotch.

Spirits are practically untouched except in the "towns," and this is greatly due to the influence of the women, who are much opposed to the use of liquors of all kinds, even to the colonial "dop."¹

At most times the back-country farmer has all his capital invested in land or stock, and he cannot be induced to pay for anything in cash. Although the head of every family stores his money in some secret hiding-place, in the framework of his bed or below the floor, he would not think of making use of it except on the gravest occasions, and far less of depositing such funds at interest in a bank.²

The men are fairly well travelled in their own district, but all are grossly ignorant of the rudiments of general knowledge. I have frequently been told I was a liar for saying the earth was round! And it is quite impossible for them to grasp that very different conditions of life obtain in other parts of the world.

With all their little peccadilloes, the Dutch are deeply and genuinely religious. Few agnostics are to be found amongst them. But to show the difficulty there is, and always will be, in the Englishman understanding them, they will never hesitate to evade the truth to get the better of a bargain.

Their thoughts and actions are based upon the desire of gaining their own ends, irrespective of religious scruples, if they have any, for by continued perusal of the Old Testament, which forms the bulk of their Biblical reading, they have come, perhaps unconsciously, to liken themselves to the chosen race.

As might be expected, the religion in itself is so simple as to verge on the uncouth, for, although a minister occasionally travels round from farm to farm, the average Boer obtains practically no religious instruction, and so builds up for himself a faith based upon what he acknowledges to be fundamental truths, and upon such ideas as have been implanted in him in infancy. At nachtmaal, it is true, he has the opportunity of listening to a pious discourse, but doubtless finds it hard to rivet his attention at a time when there is so much to divert it.

Indeed in the whole great extent of country with which we are treating there are no churches, except one in each of the few villages mentioned in the text; and even at those places the congregation seldom think it worth while to support a regular "predicant." For an example of the properly conducted service it is necessary to visit the more frequented parts of the Colony, the towns of the Orange River Colony, or the Transvaal. It bears great resemblance to that of the Church of Scotland, as also in the profession of faith, in which there are no points of radical difference.

¹ "Dop," Cape brandy.

² In poor years, and often at other times, barter is resorted to.

At the farms it is usual to have morning and evening prayer, which frequently includes the singing of a psalm immediately after getting up from and before going to bed. On Sunday, between ten and eleven o'clock, one of the senior members of the family conducts service. It is customary to begin by singing a psalm, which is followed by prayer, reading of the Old Testament, and so on, but though every household conforms to this general custom, there is nothing in the shape of a liturgy. The singing is carried on at the top of their voices, and very unpleasant it is to listen to at close quarters. Prayers may be said aloud by any member present, though I fancy it is somewhat of a privilege usually reserved for the men. It is generally in the form of a petition closely concerning themselves; it may be for rain, for blessings on the Lord's chosen people, and in particular on the inmates of the house, for the swift destruction of their enemies, for the safety and success of their spiritual and political leaders, and for preservation against contamination from those who belong to the big cities—those sinks of immorality, wickedness, and vice—and who come into their midst but for their own aggrandisement, like the Aasvogel to feed upon lambs. In some houses, Sunday afternoon, after the usual siesta, is again devoted to prayer, whilst grace before and after meals is invariable.

At all such times the elders assume the mien of undeviating absorption, which cannot be simulated by their juniors, who are obviously often wearied out by the frequency and monotony of their devotions. And yet, paradoxical as it may seem, those who know the Dutchman best will not allow that he is a hypocrite. Personally I should doubt if one can find firmer adherents to their own church than these rough farmers. Unsophisticated and unrestricted as they are in all their actions, it is but natural that their religion should also be broad and simple so as to appeal to those that are born and bred on the veld. Yet although simplicity in form and freedom of worship are the chief characteristics of the Dutch Church,¹ it signally fails to inculcate morality on anything like European standards. This is certainly difficult where the codes of morality, honour, and chivalry are so different.

Although, like all South Africans, the Dutchman shows little courtesy to the gentler sex, for which the latter have themselves much to blame, yet it must not be supposed that he is utterly destitute of manners; for, except amongst the poorest class, living in remote parts, he is infinitely more hospitable and civil than are the Jewish, German, and English population of the local "towns."

The Dutch compare very favourably with their social equals in Europe; but of course they are very uneducated. To some extent they realise this drawback, and parents will now take considerable trouble to procure a good education for their children, whose aptitude for learning is remarkable.

The quiet life led by several generations in the solitude of the veld seems to have strengthened without cultivating their mental power, and

¹ In speaking here of the Dutch Church, its three divisions have been treated as a whole without entering upon the merits of any particular branch.

in this respect they contrast favourably with the sharp but shallow-witted town-bred folk.

From the white let us now turn to the black population, and note the changes that have occurred during the last fifty years or so.

Without going into details of past history it will suffice to mention that prior to the Dutch occupation the country was inhabited by Bushmen and Hottentots who had been driven further and further back into the mountains and desert fastnesses by inroads of bands of Kaffirs coming from the East. The Kaffirs being a pastoral people did not venture very far west of the present railway line, south of De Aar—Kaffirskraal in the Beyersberg¹ being one of the most western points attained.

This was the condition of affairs when small parties of Dutchmen gradually crept forward and settled on the land, with the inevitable result that a bitter struggle for supremacy ensued, and it was not till after many years of warfare and barbarous reprisal that the natives² were finally subdued. There is not a Boer in the country who cannot tell of the unspeakable horrors of a native raid; for when the black man attacks, he strikes when least expected, usually at night, sparing neither woman nor child.

In these wars the Bushmen were hunted down and exterminated, partly because they seemed to be nearer allied to the brute beast than to man, and partly because of the impossibility of domesticating them.

At the present day there are none south of the Orange River, though a few years ago they were still to be found in parts of Bushmansland, and it seems probable that they still visit certain localities there at such times when herds of springbok and game³ are driven south for want of pasturage and rain; but in ordinary circumstances they are not now to be met with except in the depths of the Kalahari Desert.

The average Dutchman can tell nothing of native history, except what has come within his own personal knowledge or within that of his father; whilst the native, with his natural distrust of the white man, feigns ignorance or stupidity whenever questioned on the subject. Once or twice only with the persuasion of a handful of "baccy" have I been able to get old coloured men to speak of their youth and of their forefathers. But on each occasion the difficulty arose of ascertaining how long ago the events related had occurred. The only evidence from which deductions can be made lies in the knowledge of what the natives are like to-day.

However, as the Bushmen are generally considered to be of an older origin, they have a claim to be considered first.

My information regarding them has been derived from the Dutch and a few English colonials who have either travelled in the Kalahari

¹ Called after Beyer, who was their chief.

² Natives—Bushman, Hottentots, and Kaffirs.

³ Game includes Gemsbok and Wildebeest, but these do not leave the Kalahari.

themselves or had relatives that have done so, and it should therefore be trustworthy; but it might be as well to remember that exaggeration is a common fault, and that a colonial is a good hand at spinning a yarn.

There seems to be little doubt, however, that the real Bushmen are becoming less numerous every year, and are probably dying out. They form a race of pigmies averaging from 3 feet 8 inches to 4 feet 2 inches in height, and are of a copper yellow colour somewhat like the Hottentots. They live on game, killed with poisoned arrows, and roots, whilst "sanna"—a kind of wild melon—supplies them with drink during at least certain portions of the year. A marvellous instinct for finding water is attributed to them, and it is even said that in certain parts they suck it from the ground by means of hollow reeds inserted to a depth of only 6 or 9 inches in the sand. These strange, half-starved, barely human creatures lead a nomadic existence singly, or at certain times of the year in pairs; merely scraping a shallow hole in the ground in which to lie at night, or sometimes collecting a little grass for the sake of extra warmth and comfort.¹

The difficulty of sustaining life is the reason for their not settling permanently at any one place and for their solitary manner of life, and it is due to this that the females, who by the way are accredited with always giving birth to twins, invariably kill one child, if not both.

In some of the most remote parts we ourselves came across so-called Bushmen, but these seemed in fact to be but a low type of the Hottentot race, or to be half-bloods between the latter and the Bushmen proper. They work on the farms, but never for long, preferring to return to their nomadic habits, and to live on the veld for months at a time.

Let us now turn to the Hottentots, who are the ordinary coloured people on the Karroo. They differ most conspicuously from the other native tribes of South Africa in being of a yellow colour and in having broad low foreheads and high cheek-bones, denoting possibly Mongolian extraction.

Their hair grows in curly tufts like that of other natives, but not nearly so thickly, whilst the face is practically bare, except in the case of old persons, when a lanky growth appears on the chin.

The women are remarkable for their grotesquely large buttocks, the upper portion of which protrudes from the body at a very sharp angle, thus forming an admirable seat for their piccanins² which they carry slung in a blanket straddle-legs across the back. The weight is taken entirely on the buttocks, the blanket being used to form a kind of nest to prevent the child from falling off.³

The Hottentots are very prolific, and the advent of the white man in their midst is having marked effect; the number of half-castes is

¹ The Kalahari Desert is not absolutely destitute of vegetation as often supposed, but covered with sparse grass between the sand-dunes, which, however, keep continually shifting according as the wind blows.

² Piccanin—native word for baby.

³ What is known in medicine as the "Mons Veneris" is also a remarkable, though artificial, peculiarity of these women.

increasing yearly, so much so that in another generation or two a large section of the native population will be white.

Evidence of this is apparent at all the local towns, of which Carnarvon is as good an example as any. A missionary settled here in days gone by on what was then the farm lands of Schietfontein, where in course of time he collected the natives around him and founded a proper mission station. At a still later date white men began to take up their abode here too, with the present grotesque result of white and black living practically in the same street together.

It is extremely mischievous when so little distinction exists between white and black—as is the case here—when the latter resides with and lives on an equality with the former, and when he even possesses a franchise. The average white man in the country associates far too readily with the native, and it is not an uncommon sight, for instance, to see a transport rider, not only chatting round the camp-fire in company with his “boys,” but even eating with them out of the same cooking-pot. Were this all perhaps no great harm might be done, but the stamp of conversation is often of the lowest description and of a kind punishable by death in many tribes in the natural state. Yet more, when social and sexual intercourse is combined with the grossest immorality, it cannot be expected that one man should have respect for another who has not any even for himself. It is indeed hurtful to a coloured race to be brought in touch with Western civilisation, and to come under the demoralising influence of missionaries who try to instil doctrines far above their intelligence.

To return to personal matters, the reader may recollect that we experienced considerable difficulty in the vicinity of Kenhard, and in consequence our stay there was protracted much longer than we had at first anticipated.

Since leaving Carnarvon we had trekked between 400 and 500 miles, and bad food and water had told upon man and beast. Wheat was the only kind of grain obtainable, and the animals thrived far from well on it. They were suffering constantly from sand colic, too; yet although we carried drugs with which to dose them on the first symptoms, and took every possible precaution, we lost one of the horses from it.

We ourselves were laid low with a short but sharp attack of dysentery caused by the filthy and bitter water which we had to put up with wherever we went.

So our delight was unbounded when before leaving Kenhard the long drought of several years' standing was at last broken by a heavenly, life-giving rain, which continued to fall for nearly three days throughout the district.

When at length we turned our faces northward, pans, rock-pools, and vleis were full, rendering our journey possible along any road and in any direction desired.

My companion and I left Kenhard by different routes, and did not meet again until reaching Ratel Draai, nearly two-thirds of the way to Upington. It was particularly noticeable here that grass was taking

the place of the ordinary veld scrub that had so far prevailed. In the journey itself nothing of special interest occurred except the difficulty we experienced in getting through occasional sand-dunes that were now making their appearance.

Towards the end of May we encamped on the south side of the Orange River, opposite Upington, preferring to remain there rather than to move into the town, owing to the difficulty of getting through the heavy sand in the low ground, which extends for at least half a mile from the river bank. This low ground is cut up with intricate and deep channels, being almost entirely flooded when the river is high;

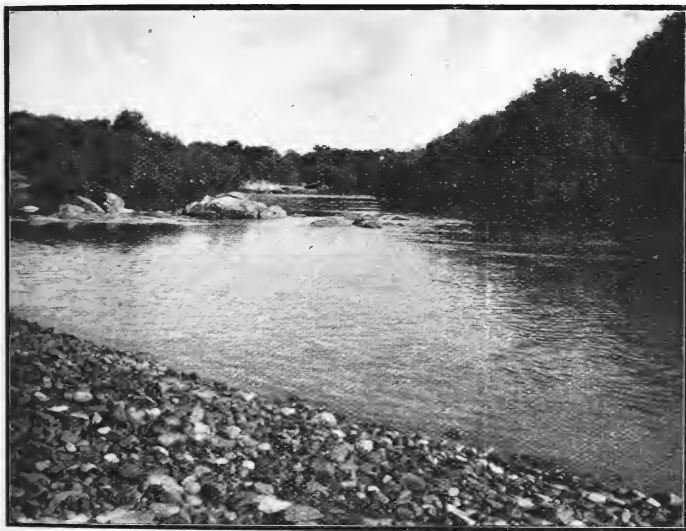


FIG. 7.—View amongst the islands on the Orange River, near Upington.

it is mostly covered with trees and bushes of various kinds—*Mimosa* being the predominating and finest class of timber. In fact it all makes an ideal home for the small grey monkeys that live there.

The road itself zigzags through the bush, avoiding as far as possible the deepest sand and water-courses, and finally emerges on the top of a bank overlooking the river. A good pont is in use here, and is practically the only means of access to Upington from the south, the drift being only possible when the water is very low, and not being considered safe even then.

The village stands on the top of the very steep bank on the north side, into which a deep cutting has been made to allow heavy transport to get up from the landing-stage. All the same it is frequently found necessary to inspan double teams to the waggons.

Although the ferry was working day and night, it was no uncommon sight to see seventy to eighty waggons waiting their turn to cross. For at this time the war in German South-West Africa was in full swing, and supplies of all kinds were pouring through from all the chief seaport towns in South Africa. Upington was alive with contractors, transport riders, and others—all "on the make," and they were doing it well.

In ordinary times the town would be similar to other back-country villages were it not for the interest that centres round the divisional



FIG. 8.—Pont across the Orange River—Upington.

head-quarters of the police, who are instrumental in bringing a little money into the place.

A small church, bank, post-office, a few stores, one or two good houses, and some nice gardens and orange-trees are really all there is here. The accompanying photograph gives a better idea of this small border town than can any description of mine.

Before closing this paper a word may be said on the climate, which must be acknowledged to be one of the most important factors that govern the prosperity or decay of the country. There are long spells of drought, and there can be no doubt that the land is, as the farmers generally assert, gradually drying up, but this may be partly accounted for by the annual deposit of sand swept up from the Kalahari Desert by the prevailing north-westerly winds.

As regards temperature, we find that places on the high veld like Victoria West or Carnarvon are particularly cold in winter and pleasant

in summer, whilst others on the Orange River are just the reverse—pleasant in winter and broiling hot in summer. At Upington a temperature in the shade of 120° Fahrenheit is often registered.

Everywhere vegetation is strikingly monotonous, consisting nearly entirely of veld-scrub, except in the north, where grass takes its place. Mimosa, willow, and “wacht een bietje” thorn grow along the banks of the largest rivers, whilst the stunted Karree boom¹ is common enough on certain hills. The Koker boom (*Aloe dichotoma*), likewise, flourishes on the driest, hottest, and most rocky kopjes imaginable, but only on and to the north of the Kokerberg. Its thick peeling bark, straight stem, and cactus-



FIG. 9.—Koker boom (*Aloe dichotoma*)

like head, give it an ugly though remarkable appearance, a good idea of which can be obtained from the photograph. Amongst the smaller plants we find prickly pear and other cacti, numerous bulbs, and after rain thousands of varieties of flowers. The “Tontelbosch”²—so called from the white, silklike fibre in the pod, with which the “vor-trekkers” used to make tinder—is very common in the dry beds of streams and along their banks.

Having completed our work at Upington and made our final arrangements, we at last set off with the donkey waggon, mule cart, and

¹ “Boom”—Dutch word meaning tree.

² This plant is particularly favoured by large brilliantly coloured locusts, of which the female is conspicuous in being bigger than its mate.

one remaining horse to trek into Prieska—a distance of about 150 miles.

Although the road was very sandy and cut up by the German traffic, all went well till near Koegrabe, where we encountered considerable difficulty in getting through a sand-dune, losing thereby a great deal of time. Annoying as the delay was it was nothing in comparison to what was yet in store for us. After slowly toiling on for some miles we came towards evening into the midst of regular sand-hills, in which we became firmly embedded. As all our efforts to extricate the waggon were of no avail, and the animals were becoming



FIG. 10.—In the sand-dunes.

thoroughly tired and disheartened, we had no choice but to bivouac where we were and wait till morning. At break of day we were up and unloading the waggon, then after inspanning both the mules and horse to the donkey team, we finally got through by dint of much struggling. I need hardly say that it was some time yet before the discarded forage and equipment was picked up—an ordeal bad enough in ordinary circumstances in the deep sand, but made ten times worse by a strong wind which carried blinding clouds of dust before it. We were very glad when we saw the waggon at last creeping forward again, for, including rest, we had taken between seventeen and eighteen hours to get over about a mile of ground, and still more so on finding water a short way on. Such slow progress, combined with the irritating effect of the hot wind of the desert, and thick dust, was most depressing, as

we felt that if we met with many more similar experiences we should be considerably overdue in arriving at Prieska, if indeed we did not run short of provisions and forage on the way.

However, taken on the whole, the road somewhat improved from here, though once more we got rather badly stuck a day or two later. As before, we outspanned the mules and were just fixing them up in front of the donkeys, when the horizon suddenly darkened, the wind chopped round, and we saw that we were in for a storm; but not a storm in the ordinary sense of the word of thunder or rain, but a sand-storm—which is infinitely worse. It approached in a solid, thick, yellow bank rather like a London fog, and very quickly. In a few minutes accompanied by a roaring wind it was upon us; breathing became so difficult that it was only possible to do so by turning one's back to the storm, and there was nothing to be done but try to get what shelter one could from the waggon, cover one's face with a handkerchief, and utter fervent prayers that it would soon be over.

After about twenty minutes or so the worst was past, and we were able to struggle out of the dune and trek on. It was well on in the night before we halted at some distance from a large pan containing water; although there was a half moon it was very dark owing to the thick canopy of foglike dust which was still drifting along.

So disagreeable was this—so painful indeed, especially to our eyes which were bloodshot, and which we could barely open—that we lost no time in getting up the tent, which never was used except in a standing camp. Altogether it was a very unpleasant experience, and one I should be sorry to have to go through again.

Nothing requires special notice during the remainder of our journey. We passed Dragoender, which is a farmhouse and hostelry combined, and so on through the Prieska Mountains to Glen Allan, where a second party took over our animals and equipment. Without loss of time we rode in the few miles that yet separated us from Prieska, where after shaking the last of the desert dust from our feet we took train for Cape Town.

Thus our long journey came to an end, for at Cape Town we found our destinations lay far apart, A. having to return to his regiment in Orange River Colony, and I having to sail for home.

As we bade each other farewell, it was not without feelings of regret on my part as I recollected the nine months we had spent together in a wonderful though desert country, and the different experiences we had encountered there.

It may be worth mentioning that the distance we had trekked cannot have been less than 2000 miles in all.

ATHENS.

NOTES ON A RECENT VISIT.

By RALPH RICHARDSON, Hon. Sec. R.S.G.S.

ALTHOUGH Athens is a small and relatively an unimportant town, it contains remains of antiquity and is surrounded by a halo of history which give it a foremost place among the cities of the world. Modern writers have lavished upon it terms such as they have applied to no other city. Milton hailed it as "the eye of Greece, mother of arts and eloquence." Dean Farrar speaks of the "eager gaze" with which the modern traveller scans the scenery and outline of Athens.

The scenery of the country around Athens lacks, to a Scottish eye, verdure and woodland, its hills are bare, its general appearance is one of desolation, yet, when the mountains and sea with which Athens is girt are lit up by the setting sun, a magic touch is given to the landscape and bestows on it an extraordinary beauty. Then the Acropolis with its far-famed temples stands out clear and impressive, while the innumerable peaks of the mountains of Ægina and Salamis and the country beyond acquire definite form, and the heights of Hymettus, Lycabettus, and Pentelicus are flooded with a purple glow.

Athens is situated about the same level above the sea as Princes Street, Edinburgh. The capitals of Greece and Scotland have topographically much in common. Both are in the neighbourhood of the sea, the port of the one, the Piræus, being four miles distant from Athens, while Leith and Edinburgh now form virtually one town. The Acropolis corresponds to the Calton Hill and is of similar height, while, although immensely less imposing, the National Monument on the latter looks like a fragment of the Parthenon. Nor does Athens lack its Arthur's Seat, for it finds in its Lycabettus an isolated hill in its immediate vicinity although 88 feet higher than its northern representative. But Athens possesses none of those magnificent evidences of ancient volcanic energy which give to Edinburgh a site unequalled in picturesque grandeur. It has no Castle rock, no Salisbury Crags. Even its Lycabettus and Acropolis are but eminences of limestone, schist, and marl, and are not the products of volcanic outbursts like Arthur's Seat, the Calton Hill, and other heights around Edinburgh, and do not produce the same scenic effect.

The geology of the environs of Athens was described by Herren Bittner, Neumayr, and Teller, with a geological map of Greece, in the *Denkschriften der Kaiserlichen Akademie der Wissenschaften*, published at Vienna in 1880 (vol. xl. p. 379). It is also displayed in the *Carte Géologique Internationale de l'Europe* (Feuille, 39 D vi).

From these authorities we learn that the city rests on crystalline schists, with a tract of alluvium stretching from the north-west of Athens to the coast at the Piræus and Phalerum. The outlying hills around Athens known as Hymettus and Pentelicus consist of metamorphic rocks

and produce marbles which have been divided geologically into upper, middle, and lower, all of which are found on Hymettus. The famous Pentelic marbles belong to the upper group.

With regard to Lycabettus, the Athenian Arthur's Seat, a local guide-book describes it as consisting of a substratum of greenish-grey slate and sandstone, over which is marl interbedded with limestone, while the topmost layer is of blue-grey limestone.

To the north of Athens are Neogene rocks consisting of Miocene and Pliocene Tertiaries, and in them some very remarkable geological discoveries have been made. In Miocene times Greece was united to Asia Minor by great plains on which grazed huge animals such as the *Dinotherium*, *Hipparion*, and *Giraffe*, now found fossil in Greece. In the Pliocene of Pikermi to the north-east of Athens were found remains of *Rhinoceros*, *Hipparion*, *Mastodon*, *Dinotherium* and other extinct fauna. These Pikermi beds, which have become celebrated in the annals of geology, extend from the upper slopes of Pentelicus to Marathon. They consist of breccia conglomerate and sandy marls, and are noted for their bright red colour and fertile soil.

The coast of the Bay of Eleusis to the west of Athens consists of alluvium and upper cretaceous rocks, with Neogene rocks and alluvium stretching past the Piræus and Phalerum, followed by the Hymettus range with its varied development of marbles. That denudation on an extensive scale has planed the rocks around Athens is evident from their mammilated appearance, while the harder deposits such as form Lycabettus and the Acropolis have so far resisted the denuding agencies as to stand out to-day as eminences.

To those who are acquainted with the scenery of Derbyshire that of the country around Athens would seem familiar, for both largely consist of limestone producing a bare and treeless, grey and stony, landscape without verdure. Thus an air of desolation spreads around Athens, and one misses the wooded hillsides and verdant fields which under other geological and meteorological conditions might have obtained. No more delightful change can be imagined than to go from the stony surroundings and dusty atmosphere of Athens to the Royal country house of Tatoi (a two hours' drive to the north) with its magnificent expanse of forest and exquisite mountain air.

With the exception of the alluvial tract stretching from the north-west of Athens to the Piræus and Phalerum, the soil is thin, a fact which did not escape the attention either of ancient or modern observers, Plato comparing the country round Athens to the emaciated body of an animal whose bones showed through its skin.

Milton also referred to the same characteristic in pointing to the land

"Where, on the Ægean shore, a city stands
Built nobly, pure the air, and light the soil."

Thus, with one of the finest climates in the world, the limestone soil of Athens is by no means productive. Absence of good grass makes the goat, not the cow, predominant. Vegetables are scarce. Trees and

cultivated flowers are rare. Even the water is not above suspicion, for it is hard and leaves an unhealthy deposit, while the dust produced from the rocks around Athens and from its unpaved streets is not only one of the chief drawbacks of the city, but is also said to cause consumption by attacking the lungs. The absence of rain in spring dries up the streams, and we found that the famed Ilissus, by whose banks Plato once walked and taught, lacked the chief charm of a river—it contained no water.

One of the attractions of Athens is its fine climate at a period of the year when that of Scotland is often peculiarly trying. At the close of April 1907 the weather in Athens was superb, the thermometer ranging daily from above 60° to above 70° Fahr. in the shade, often with a cloudless sky. We saw barley being harvested in fields on the road to Eleusis on 1st May, and were told that from the middle of that month onwards the heat becomes such that the streets of Athens are deserted at midday. There is a well-equipped observatory on the Hill of the Nymphs, near Athens, situated 321 feet above the level of the sea, and commanding a magnificent view in every direction.

At present the chief routes from Britain to Greece are either by the Mail route from London to Brindisi by railway and sailing *viâ* Corfu to Patras, whence railway to Athens; or by train to Marseilles and steamer to the Piræus. The steamers of the Austrian-Lloyd Company from Trieste *viâ* Brindisi, Corfu, and Patras to the Piræus, and from thence to Constantinople, are extremely well appointed. But the heyday of modern Athens will not arrive until it secures railway communication with the rest of Europe. At present the railway from Athens northwards stops at Larissa, and sixty miles of railway would require to be constructed to carry the line on to Verria in Turkey and link it with the railway system of Europe. Sixty miles of railway would be thought nothing of in South Africa, but as Greeks and Turks hate each other, and neither have any money, some other authority (probably German) will have to supply the missing link. Then a new era will dawn upon Athens, which will be put in direct railway communication with Budapest, Vienna, Berlin, and Paris, and travellers will go to Athens by "Athenian Express" with as much rapidity and comfort as they now do to Constantinople by the "Orient Express."

Before that event occurs, however, the Athenian authorities must "mend their ways." Even in Constantinople the streets are paved *à la mode Turque* with cobble-stones. In Athens they are not paved at all. They certainly possess *trottoirs* (or foot-pavements), but the rest of the street remains in a state of Nature, with the surface left untouched and full of ruts, forming a sea of mud in wet weather and an accumulation of dust in dry. The Athenian mind appears to see no incongruity in streets which often contain magnificent marble buildings and fine shops, having roadways like hill tracks. A portion of the Æolus street has been asphalted, but it is the only street in Athens of the kind.

Yet the Government do not seem to lack money for the art of war, for we saw at Patras several of the eight new torpedo-boats which have just been added to the Greek navy. Greek finance has always been

considered a debatable quantity, but, judging by the improved rate of exchange, it must be more stable than formerly. According to Macmillan's *Guide to the Eastern Mediterranean*, the rate of exchange in Greece in 1901 was "usually about 40 paper drachmas to the sovereign." In April 1907 the exchange was 26 drachmas, 90 leptas, to the sovereign—a very great difference. The Greek currency consists of the drachma of 100 leptas, corresponding to the franc of 100 centimes. Silver coins are rarely seen, the ordinary money used consisting of nickel coins denoting leptas, and paper money for drachmas. Seeing that paper is issued for so small an amount as a drachma (or 9d.), and also that the paper notes pass through an untold number of hands until they become yellow and almost illegible, the debased character of Greek currency is beyond question.

Putting aside, however, all these drawbacks, no more attractive or interesting town than Athens, for a short stay, can be imagined. The people are kind, quiet, and polite. Like all Greeks, they are said to be very fond of the British, and this is not surprising, for no Greeks ever pleaded more warmly for Greece than did Byron and Gladstone, names revered throughout Hellas. Both have had marble monuments erected to their memory in Athens, for it was to the British poet and statesman as much as to any others that Greece won and kept the independence she enjoys to-day. It is a remarkable, but exact, historical fact that the undeniable popularity enjoyed by the British throughout Italy, Hungary, and Greece is due to the circumstance that, almost alone among the nations of Europe, Britain countenanced and substantially aided these countries in achieving their liberty.

The chief visitors to Greece, however, are not the British but the Americans, whose Government, like that of Britain, France, Germany, and Austria, supports a special Archæological School in Athens. It is interesting to note the homage paid by the citizens of the great Republic of the West to its small but immortal prototype. Next in number to the Americans come the Germans, and only after them the British. German devotion to Greece is, however, by no means new. No one admired Greek art more than Goethe, and no one sympathised more with the Greek struggle for independence. When Byron left for the front in 1823, Goethe, who was then seventy-four, sent him the poem beginning:—

"Ein freundlich Wort kommt eines nach dem andern
Von Süden her und bringt uns frohe Stunden ;
Es ruft uns auf, zum Edelsten zu wandern :
Nicht ist der Geist, doch ist der Fuss, gebunden."

Byron died next year at Missolonghi, opposite Patras, aged thirty-six, a prey to the great exertions he made for the Greeks, whose independence, according to a recent Scottish writer in the *Spectator*, "gave an impetus to the rise of national sentiment throughout the Balkans."

The Athenians seem to be a very religious people, and the numerous churches of the Greek faith are both well kept and well attended. The older ones are quaint little buildings of Byzantine architecture, and out-

wardly have a beehive form. The church called Kapnikarea contains a tablet stating that it was founded A.D. 418 by Eudisia, wife of Theodosius the younger, Emperor of Constantinople, while the old Metropolitan Church is said to have been built by the Empress Irene A.D. 775. Both are very curious both outwardly and inwardly, and the latter has ancient Christian symbols, such as the vine and the dove, in relief on marble.

The interiors of the Greek churches at Athens are clean and elegant, and are decorated with good pictures of saints, with an absence of the garish ornament so common in Roman Catholic churches. The worshippers on entering cross themselves vigorously and then proceed to kiss the glass frame enclosing the picture of their favourite saint. Then they purchase a taper at the door, and, lighting it, place it before his shrine. Tapers are for sale at various prices.

We witnessed a service in the little church on the summit of Lycabettus, and were struck with the number of persons who took the trouble to climb to the top of this hill (910 feet) to attend it. The service was of the very simplest character, and the only difference in the general conduct of it, as compared with the Anglican or Roman ritual, was the disappearance of the priest at intervals behind the Templon, a partition which, in Greek churches, completely separates the altar from the rest of the church. The Greek priests are generally good-looking, full-bearded men, wearing long hair, and black gowns, and high hats, whose brims are above and not below the hat.

Good Friday was celebrated in the Greek Church at Athens on 3rd May last, the Anglican celebration having been on 29th March. We were fortunate to be in Athens at that time, and to witness scenes of great popular excitement. After all, both in Athens and Constantinople, it is the striking religious observances of the people that make the greatest impression on the tourist's mind. In Athens on the night preceding Good Friday the churches were crowded, and although all the worshippers remained standing, for Greek churches are not seated, the services were protracted till midnight.

In every church on Good Friday a bier lay in front of the Templon, and on it lay a Bible. Worshippers of every class pressed forward all day long to kiss the Bible and the bier, the latter being covered with flowers. At night the congregations of the various churches headed by their priests, formed processions through the streets, accompanied by military bands playing, and choristers singing, religious music. Crosses and banners were carried as well as the palls of the biers which had lain in the churches that day, and as they passed every spectator uncovered and crossed. The Metropolitan Bishop in robes and mitre, accompanied by the Prime Minister and the highest political and military functionaries of Greece, walked in the procession to the Cathedral of Athens. The whole population of Athens was astir, and most of the people carried lighted tapers, forming a scene of universal religious enthusiasm which probably no other European country could display.

Religious processions, however, have always been the custom in Athens, for a frieze of the Parthenon (now in the British Museum)

represents the procession of the Panathenæa, when maidens of the noblest rank, carrying gifts and accompanied by a great crowd, walked in solemn procession to do homage to Athena, the goddess who was the guardian of Athens.

Athenian funerals differ from ours in that the face of the deceased is exposed, and the corpse, covered with flowers, is borne through the streets preceded by a band of priests singing the funeral service. As the corpse passes, every hat is raised and every one crosses himself or herself repeatedly. We noticed also that, preparatory to Easter, the habit of praying by telling beads was general, well-dressed men having strings of fine amber beads, while in the lower ranks simpler ones were employed.

The absence of women, or at all events the overwhelming number of men seen in the streets of Athens has been ascribed to the women still seeking seclusion as in the days of their Mohammedan rulers, for we must remember that the Greeks were under Ottoman sway from 1456 till 1830, or 374 years. But, as Professor Tucker remarks in his recent most interesting book on *Life in Ancient Athens*—"At Athens, more than anywhere else in Greece, the woman was thrust, both publicly and socially, into the background." Even Plato who, on this subject, was more liberal than most Athenians, expressed the opinion that the special excellence of a woman was "to keep house well, and obey her husband." In modern Athens men and boys do all the trade, for it is not thought proper that a woman should work outside her dwelling.

The general behaviour of the Athenians is superior to that observable in our cities. Drunkenness is not seen. Beggars are not allowed. Politeness is invariable. Rude noisy behaviour is exceedingly rare. The Athenians are still fond of Learning, and the better classes speak English accurately. They are still the active, intellectual race whom St. Paul found willing listeners, if tough disputants. They have erected in marble a magnificent University, Academy of Science, and Public Library, and seem determined to make their glorious city not unworthy of its ancient boast, "Omnium artium inventrices Athenæ."

OBITUARY.

DR. ALEXANDER BUCHAN.

By HUGH ROBERT MILL, D.Sc.

ALEXANDER BUCHAN was born in Kinnesswood, Kinross, on 11th April 1829, and was educated at the Free Church Normal School in Edinburgh, then newly founded as a result of the Disruption of 1843, and afterwards at the University, where he took the degree of M.A. in 1864. From 1848 onwards he followed the profession of a teacher, for which indeed he was naturally gifted, and throughout his life he retained the power of imparting instruction easily and pleasantly. As a schoolmaster he filled appointments at Banchory, Blackford, and lastly at Dunkeld.

But for a weakness in the throat that continued to trouble him through life he might never have relinquished the profession he had chosen.

The first scientific study which attracted the attention of Alexander Buchan appears to have been botany, and especially the study of the native plants of Scotland, though he took part in at least one of the long excursions to the Alps which Professor Balfour led through all the difficulties of continental travel at that period. The field botanist cannot but be interested in the weather, and we may assume that it was in this way that Buchan's thoughts were turned to meteorology.

The Scottish Meteorological Society was founded in 1856; and its early records give full particulars of the qualifications, appointment and withdrawal of successive secretaries; but curiously enough nothing is said in the published minutes of the retirement of Mr. A. H. Burgess, who was in office at the meeting on 3rd September 1860, or the appointment of Mr. A. Buchan, who read a paper as meteorological secretary at the meeting of 11th April 1861. The subject was the cold weather of the previous Christmas, and this, so far as I can ascertain, was Dr. Buchan's first contribution to the literature of meteorology. It is interesting to observe that even at this early period he treated the problem in a distinctly geographical manner, and he called attention to a fact, the importance of which he often referred to afterwards, the remarkable difference in the distribution of low temperatures according to the configuration of the surrounding land surface. The paper concludes: "Thus the highest winter temperature is to be found along the west coast; the lowest in low plains at such a distance from the sea as not to be influenced by it, and in hollows enclosed by hills; and all places elevated above the immediately surrounding neighbourhood are effectually protected from the extremes of temperature."

Throughout his life Dr. Buchan always insisted on the importance of taking the character of the site of a station into account before using its record in drawing any general conclusions as to climate. It is not surprising that he became an original member of the Royal Scottish Geographical Society, and took a constant interest in its welfare.

From 1861 onwards Dr. Buchan was nearly as much the author as the editor of the *Journal* of the Scottish Meteorological Society, the "new series" of which was started in the following year. He spent much time on the discussion of barometrical observations during the early years at the Society, dealing at first with the records for Scotland, but soon passing on to consider the data for the whole world. It was the period of most rapid advance in meteorology, the principles of the synoptic weather chart, of the relation of wind direction to the isobars, and of scientific forecasts of the weather for short periods had just been enunciated, and thanks to the enthusiasm with which Buchan took the matter up in these early years the name of Buys Ballot and the extension of the relation between barometric gradient and wind direction were soon thoroughly familiar in this country.

In 1867 he published his *Handy Book of Meteorology*, a second edition of which appeared in the following year. This book showed so firm a grasp of the principles of the science, and so thorough a

mastery of observational detail, that it became the standard textbook in the language; and in later years many were the appeals made to the author to bring it up to date, but the increasing volume of official work and the burden of various important researches were such that the appeals had to be made in vain. In one way it is perhaps better that the book should remain as a landmark of the meteorological knowledge of forty years ago, for the time has now passed in which it might have been possible to adapt the frame for the picture of that day to the ampler canvas of the present. Following on the larger work an *Introductory Textbook of Meteorology* in 1871 presented no new features.

In 1869 Mr. Buchan read to the Royal Society of Edinburgh the paper by which his reputation as a leader in meteorology was established at once and for ever throughout the world. It dealt with a subject of such difficulty and complexity that only an enthusiast in the marshalling of figures could ever have attempted it with any prospect of success—no less a problem than the charting of the mean distribution of atmospheric pressure and of prevailing winds over the globe. This paper was perhaps the most fruitful, though it was far from being the most laborious piece of work which Dr. Buchan accomplished. A natural result was that on the return of the *Challenger* expedition in 1876 the vast mass of meteorological data accumulated in every part of the world was handed over to Dr. Buchan to report upon. Following the enlightened practice introduced for all the reports of that great expedition, additional data accumulated before and after the expedition were utilised, and so Dr. Buchan was able to prepare as the basis of his *Report on Atmospheric Circulation*, published in 1889, maps of the world representing the mean temperature and also the mean barometric pressure and wind directions for every month as well as for the year. These entirely original maps went far towards forming a meteorological atlas, and when only a few years ago Dr. Buchan, in association with Dr. Herbertson, undertook the editorship of the volume on Meteorology in Bartholomew's great *Physical Atlas* the data compiled for the *Challenger* Report formed one of the most striking advances on the Berghaus Atlas upon which it was based.

Oceanography occupied a considerable share of Dr. Buchan's attention. At an early period he had organised observations of sea temperature in connection with herring fisheries, and in later years he contributed a massive memoir on "Oceanic Circulation" to the *Challenger Reports*.

Climatology, that department of meteorology which is equally a department of geography, always claimed the lion's share of Dr. Buchan's attention. He worked as much with maps as with tables of figures, and it is to his patient labours that we are indebted for most of our knowledge as to the monthly distribution of pressure and temperature over the British Isles.

The relation of climate to disease occupied his attention and was dealt with in several papers written jointly with Sir Arthur Mitchell, one of the founders of the Scottish Meteorological Society.

In 1883 two important enterprises engaged much of the time of

Dr. Buchan; one of these was the establishment of the Scottish Marine Station at Granton by Sir John Murray. It was at this time that I was brought into close relations with Dr. Buchan, and in the instruction I received from him in the art of meteorological observing I first recognised his vast experience and technical skill and experienced that kindly helpfulness which never ceased to the end of his life.

The second enterprise was the foundation of the observatory on the summit of Ben Nevis, and subsequently of a second observatory at Fort William. For the remainder of his life the meteorology of Ben Nevis unquestionably held the first place in Dr. Buchan's scientific work. He took his share in the efforts to awaken public interest and secure the necessary funds to start the observatories, and to carry them on, and he put forth more energy than was perhaps prudent from the point of view of health in the effort to persuade an indifferent Government to place the work on a permanent basis. This is not the place to revive the memory of old controversy or to rake up old grievances, but without stirring the ashes of the old fires it may be said that, although the departmental committee appointed by the Government at the instance of Dr. Buchan and his colleagues failed to provide for the continuation of the work he had so much at heart, it did at least make recommendations of a kind which opened the way for great improvements in the conditions of meteorological work and in the useful co-operation of the various meteorological agencies in the United Kingdom. The publication of the hourly observations at the two observatories and the discussion of the data filled his later years, and though comparatively little remained to be done, Dr. Buchan died before the completion of the last volume.

While Dr. Buchan was particularly associated throughout his long and active life with the scientific activity of Scotland, and of Edinburgh in particular, he was also well known in London, where he had a place on several important representative bodies. For many years he was the representative of the Royal Society of Edinburgh on the committee, nominated for the most part by the Royal Society of London, for the administration of the Government grant of £4000 per annum for scientific research. In 1887 he was appointed a member of the Meteorological Council, the body which, on the responsibility of the Royal Society of London, directed the Meteorological Office and administered the sum set apart by Parliament for the meteorological service of the country. Dr. Buchan also frequently attended the meetings of international committees, and was personally acquainted with all the leading continental authorities in his own department.

When the Symons Memorial gold medal was founded, the Royal Meteorological Society made the first award to Dr. Buchan as the most eminent British meteorologist.

Dr. Buchan received the honorary degree of LL.D. from the University of Glasgow in 1887. He was elected a Fellow of the Royal Society of Edinburgh in 1869, a member of its council two years later, and he received in turn the Makdougall Brisbane and the Gunning prizes of the Society. In 1878 he became curator of the library—a post which, with the permanent membership of the Council, he held until within a year or

two of his death. In my mind, and in the minds of many who frequented the meetings of the Royal Society of Edinburgh in the eighties and nineties of last century, the old rooms on the Mound will always remain most intimately associated with three notable figures—Professor P. G. Tait, for so many years the general secretary, Dr. Alexander Buchan, and Mr. James Gordon, the picturesque librarian. In connection with the Royal Society Club, Dr. Buchan shone in a sphere with which many to whom he was familiar in the streets and in his office never associated him, the purveyor of intellectual gaiety of the old Scottish type. As a host Dr. Buchan was always charming, and his breakfasts on the occasion of such meetings as those of the British Association are not to be forgotten by any one who had the privilege of taking part in them. Mrs. Buchan amply seconded his hospitality, and the guest who came even for an hour could not fail to recognise a domestic life of singular harmony. Nor can we close these notes without a tribute to the memory of Miss Jessie Hill Buchan, the faithful niece and invaluable assistant who worked for so many years in the office with her uncle; and it is sad to remember that both wife and niece passed away before himself. He is survived by Dr. Hill Buchan, his only son.

In private life Dr. Buchan was full of surprises to those who expect to find a student of science a man of one idea. He took a deep interest in church matters and was an elder in Free St. George's. He revelled in poetry, especially in the old Scottish ballads, from which on suitable occasions he could produce singularly apt quotations. He was a firm and generous friend, and all his qualities were such as to enshrine him in the memory of those who knew him in the full vigour of his strenuous years as something grand and heroic cast in the mould of Browning's "Grammarian":—

"Here—here's his place, where meteors shoot, clouds form,
 Lightnings are loosened,
 Stars come and go ! Let joy break with the storm,
 Peace let the dew send !
 Lofty designs must close in like effects :
 Loftily lying.
 Leave him—still loftier than the world suspects,
 Living and dying."

GEOGRAPHICAL NOTES.

AFRICA.

The Variations of Lake Chad.—An article in *La Géographie* for March 15 gives some results of military reconnaissances undertaken during 1906 by the troops of the Lake Chad region, and among other points gives some notes obtained from the natives in regard to the variations of level in Lake Chad. The Buddumas and Kanembus agree in giving a period of about twenty years as the limit of the ordinary

small fluctuations of the lake. The total period is probably made up as follows :—Five years of high water, five years of falling level, five years of low water, and five years of rise. Finally, at the end apparently of four or five twenty-year periods of fluctuation, there occurs an almost complete desiccation which is followed by a great rise of level. An old native was found who remembered the last great drying up, which on his evidence is assigned to a period between 1828 and 1833, while nearly twenty years later, in 1851, the level was very high. The same native stated that his grandfather told of an earlier desiccation seen by him. It would appear that during 1906 the lake was very low, but it remains for the future to show whether it has really reached its lowest point or not, that is whether or not it will now turn to rise.

The Benguela-Katanga Railway.—We are informed that the railhead of this line has now reached about 60 miles from Lobito Bay, while the preliminary reconnaissance in the direction of Katanga has reached 465 miles from Lobito Bay.

AMERICA.

Salton Sea.—In connection with Mr. Redway's paper on this artificial lake which appeared in our July issue, it is of interest to note that, according to *Science*, a careful investigation of the phenomena of evaporation in the region is to be undertaken by the United States Weather Bureau, the United States Reclamation Service, and the United States Geological Survey, acting in combination. The Colorado river has now been returned to its original channel, the lake has begun to dry up, and in future the accession of water to the basin will be merely nominal. It is estimated that from ten to fifteen years will be required for the complete dissipation of the present "Sea," and the process of evaporation is to be watched in detail from a group of meteorological stations conducted under the auspices of the bodies named above. The points to which attention will be specially devoted are, the relation of evaporation to temperature, atmospheric humidity and wind, and an endeavour will be made to develop a general formula for the estimation of the evaporation in any locality where the ordinary climatic factors are known. A reconnaissance of the locality has already been made.

POLAR.

North Polar Problems.—Dr. Fridtjof Nansen read a paper on this subject before the Royal Geographical Society in April last, of which the following is an abridged account.

The deep North Polar basin forms the northern termination of a series of depression of the earth's crust which extend north through the Norwegian Sea from the eastern Atlantic, and form a dividing line between the continental masses of the Old and New Worlds. The eruption of the Jurassic basalts of Franz Josef Land and Spitsbergen

may have had some connection with the sinking in of the bottom of the North Polar Sea, but the basin was probably to a great extent formed before the outpouring of these basalts. As yet newer volcanic rocks are not known from the edges of the North Polar basin. De Long reported basalt on Bennett Island but we do not know its age.

It is most improbable that any block of land (horst) could have remained isolated in the middle of such a basin, surrounded by deep water on all sides, and without having any connection with the surrounding lands or continental shelves. It is therefore of great importance to determine where the continental shelf ends off the known coasts. But the edge of the continental shelf in the North Polar region is only known exactly in two places, to the north-west of the New Siberian Islands, and to the north of Spitsbergen, whilst in the region between these two places we know only the deep sea to the north.

Except in these two places we have little direct knowledge of the limits of the continental shelf. The rule that such shelves are narrower outside high and mountainous coasts than off low, flat lands only holds good where the mountainous formation of the coast is in near relation to its trend, and to the continental slope outside, and also where the coast-line is built of primary rocks. This seems hardly to be the case on the northern coast of the American Arctic Archipelago and Greenland, though there are rather high promontories in places. It is possible that along the northern coast of Alaska the necessary conditions are fulfilled, and therefore the shelf may be narrower there, but even this is uncertain. It is possible that the deeper soundings which have been taken there may merely indicate the presence of numerous submarine valleys, so that further observations are necessary to delimit the continental shelf here. But it cannot be said that the geomorphologic features of the known part of the Arctic regions exclude the possibility of a wide continental shelf, possibly with lands on it, which may extend into some parts of the Unknown North.

The marine currents and the ice-drift seem to indicate that there is an extensive tract of sea to the north of the *Fram's* track. Peary's experiences also indicate that there is much sea to the north of Greenland. The ice-drift converges towards the opening between Spitsbergen and Greenland, and Peary's observation of a rapid eastward drift also indicate that there cannot have been much land to the east of his northward track. But as we do not know the depths over which Peary travelled, we cannot say much with regard to the possibility of land or continental shelf further north and east. The drift of the *Jeannette* also did not indicate land to the north.

Dr. Nansen's own conclusions with regard to an actual current in the surface-layers of the North Polar Basin, pointing towards Franz Josef Land and Spitsbergen, might seem to indicate that there was land to the north, and that the North Polar Basin is thus a long, narrow depression. For, owing to the earth's rotation, it might be expected that a surface-current of this kind would be deflected towards the coast on its right-hand side, *i.e.* towards the Greenland and American side. It is, however, he thinks, probable that the winds and ice-drift in the unknown parts of

the sea might have influenced the direction of the *Fram's* drift, and that therefore the results arrived at as to the direction of the current are not quite correct.

The statement that the difference in the amount of the tides on Bennett Island and the coast of Alaska proves the existence of extensive lands to the north, is not, in Dr. Nansen's opinion, valid; while the differences in the ice of the Beaufort Sea, and in the sea crossed by the *Fram* do not support the view that extensive land exists in the Unknown North. The occurrence of drift-wood on the northern coast, and even on the floe-ice itself to the north-west of Greenland, proves that this ice must have drifted across the unknown sea from Siberia or America. The great quantity of "Post-Glacial" driftwood, found even at high elevations on the now ice-bound coasts to the north, points to a milder period in Post-Glacial times with a more open North Polar Sea. As sledge journeys do not give sufficient opportunity for soundings and oceanographical work, Dr. Nansen is of opinion that the best results in Polar regions would be obtained by allowing a ship to drift from the sea north of Behring Straits or Western Alaska across the Unknown North and towards Greenland. The drift could probably be accomplished in five years.

The Franklin Search Expedition.—An interesting event in the history of Polar exploration is commemorated in the following letter, addressed by Sir George Taubman Goldie, President of the Royal Geographical Society, Sir Clements Markham, Vice-President of the Society, and Sir Allen Young, to the veteran commander of the *Fox*, Sir Leopold McClintock. We quote the letter in full here :—

1 SAVILE ROW, BURLINGTON GARDENS, LONDON, W.,

June 30, 1907.

DEAR SIR LEOPOLD MCCLINTOCK.—In the name and on behalf of the Council of the Royal Geographical Society, we salute and congratulate our gold medallist of 1860 and one of the most valued of our colleagues on a great occasion. For this day is the 50th anniversary of the departure of the *Fox* on her memorable voyage.

We are reminded of your long preparation for your final Arctic service, during which you became the organiser and the creator of Arctic sledge travelling. You brought your system to such perfection that you and your companion, Lieutenant Frederick Meham, achieved the wonderful journeys of 1853 and 1854—the most wonderful on record. These results afford the strongest proof of the suitability of your travelling equipments.

With such experience you were the leading Arctic authority when Lady Franklin, forced to complete the search for her husband and his gallant companions at her own expense, secured your services to command the expedition. The voyage of the *Fox* was a great landmark in the history of geography, whether we consider its conduct, its discoveries, or its momentous results. There is nothing finer in our naval annals than your firmness and resolution when, after the misfortune of being beset for a winter and then driven out of the ice in a gale of wind, you coolly turned the ship's head again "Northward Ho!" You sought no port for refreshment, but turned at once to the battle. Such indomitable pluck commanded success.

The discoverer of the fate of Franklin bears a name which will never be forgotten by his countrymen. Your book has long been, and will continue to be, one of the classic narratives of our language, recording a great achievement simply and modestly, yet in a way which fills the reader with sympathy and interest.

It is not for us to refer to your long and valuable subsequent services in the Navy and at the Trinity House; but we may express our deep sense of the value of what you have continued to do in the interests of geography and of discovery during a long course of years.

You have lived to see much valuable and some splendid work achieved in the Arctic regions, but no one has approached your unequalled journeys, and you still continue to be the greatest, as you are the first, of Arctic sledge travellers.

That you may long be spared to us, and that you and yours may continue to enjoy health and happiness, is the earnest wish and hope of your numerous friends and admirers, and, above all, of your old colleagues who take this propitious opportunity of giving expression to their feelings.

We are, dear Sir Leopold, yours most sincerely,

GEORGE TAUBMAN GOLDIE, *P.R.G.S.*

CLEMENTS R. MARKHAM, *V.P.R.G.S.*

ALLEN YOUNG, Navigating Officer of the *Fox*.

The British Antarctic Expedition, 1907.—At the beginning of July there was opened in London an exhibition of the equipment and food supplies for this expedition. The greatest care has been taken with the packing of the food supplies in order to obviate as far as possible all risk of deterioration either in the tropics or in the extreme south. Exceptional features in regard to the supplies are the 150 gallons of petrol which is being taken for the motor-car, and the bales of compressed hay, etc., for the use of the Siberian ponies. As regards the clothing, fur enters into the supplies only to a limited extent, woollen underclothing with outer clothes of heavy pilot cloth, covered externally by a coat of windproof material, predominating. The hut consists of wood, with double walls lined with granulated cork, and it is to be lighted by acetylene.

GENERAL.

Lieut.-Colonel Burnley-Campbell, a Fellow of our Society, informs us, as a point of interest connected with the development of means of communication, that he has recently accomplished the circuit of the globe, *via* the Canadian Pacific and Siberian railways, in the record time of 40 days 19½ hours. The journey was made by the route Liverpool, Quebec, Vancouver, Yokohama, Tsaruga, Vladivostok, Harbin, Irkutsk, Moscow, Berlin, Ostend, Dover.

International Congress of Orientalists.—We have received a circular of invitation to the Fifteenth Meeting of this Congress, which is to be held at Copenhagen in the second half of August 1908. The Secretary of the Organising Committee is Dr. Chr. Sarauw, Frederiksberg Allée, 48, Copenhagen, to whom application should be made.

EDUCATIONAL.

AN interesting paper by Mr. C. E. Moss on the *Geographical Distribution of Vegetation in Somerset, Bath, and Bridgewater District*, with a map and numerous illustrations, has been published as a pamphlet by the Royal Geographical Society, and contains much that teachers will find exceedingly valuable. In addition to the vegetation map in colours the paper contains two sketch maps, one showing rainfall and the other the geological structure of the district considered. The author concludes that in this district the plant associations are determined more by the soil than by the climatic conditions, and it is exceedingly interesting to compare the large map and that showing the rocks from this point of view, the relations being exceedingly clear and obvious. Throughout the paper great emphasis is laid on rock structure, and this naturally greatly increases the value from a geographical point of view. The series of botanical papers which have now been published along similar lines by our own Society and by the Royal Geographical Society are making it more and more clear that the connection between the geological composition and the vegetation of a locality is exceedingly intimate, and the geographical significance of this can hardly be overestimated. For example, in the particular district here treated the upland region consists of three types of rocks and therefore of soils. These are the sandstones, the limestones, and the deep marls and clays. Each of these has its characteristic type of vegetation; on the sandstones the dominant association is the oak wood, on the limestone the ash wood, and on the deep marls and clays the oak-hazel wood. The different plant associations are considered in detail by the author, but the essential fact is as stated above. The different types are illustrated by some very interesting and characteristic photographs. If we take, for instance, the two illustrating ash on limestone, then any one who is familiar with limestone scenery in say Yorkshire or Westmorland, will recognise at once the same type of vegetation as that indicated here for Somerset. Therefore, it would seem that the teacher, in place of the ordinary statement that in such and such parts of England limestones come to the surface, can employ a much more interesting form of presentation in saying that in such parts of England, at low levels, one would find ash woods with such and such accompanying plants, while at higher levels such and such other plants would be found. Again, in considering the Highlands of Scotland, one can now definitely correlate the uniformity of the great stretches of heather with the uniformity of the underlying rocks, and one can point out that where there is a very thin layer of soil over *limestone*, as in most upland regions in Yorkshire, heather will not grow, and its presence there indicates the presence of deeper patches of glacial clay. In Somerset there is no boulder clay, but the heather appears over limestone wherever the conditions favour the development of some thickness of soil. There can be little doubt that such teaching will appeal far more than a mere account of rock structure, for it is not the rock but the covering of vegetation that is the distinguishing feature of the greater part of the earth's surface. If, further, the method of regional geography is adopted,

and the home district is considered as a starting-point, it should be possible to use the botanical part of the nature study course as an important aid. If a sufficient number of workers are found to carry out for Great Britain generally the work begun by the Messrs. Smith, Lewis, Moss, and others, we should be able in a few years' time to reach some general conclusions on the plant associations of the different natural areas of our country, which should be of great geographical value.

NEW BOOKS.

EUROPE.

Rothiemurchus. By HUGH MACMILLAN, D.D., LL.D., F.R.S.E. London : J. M. Dent and Co., 1907. Price 3s. 6d. net.

The many admirers of the works of the late Dr. Hugh Macmillan will welcome in this little volume a series of sketches which he contributed to the *Art Journal* some time ago. They form a charming description of the district seen from Aviemore to the south, which contains a group of giant peaks of which Ben Macdhui is the highest, although not perhaps the most striking. As may be expected, when we remember they were written for the *Art Journal*, the sketches are distinguished by wealth of brilliant and even florid description of Highland mountain scenery. But those who have lived on Speyside and explored Rothiemurchus and the Larig Ghru will be the first to admit that the descriptions are not overdrawn. The photographs by which the book is illustrated are exceptionally good.

Sark: The Gem of the Channel Islands. By MRS. HENRY BOWLES. London : Arnold Fairbairn, 1907. Price 3s. 6d.

This handsomely got-up little volume may best be described as a series of very beautiful photographs, depicting the scenery in Sark, one of the Channel Islands, with a running commentary of letterpress. Its deserved popularity is attested by the fact that although the first edition appeared in December last, a second edition was required in February.

The Book of Capri. By HAROLD E. TROWER, B.A., British Consular Agent at Capri. Naples : Emil Prass, 1906. Price *Lire* 5.

This volume appeals for the most part to the student of history and archæology, and may justly be described as an erudite compendium of all that can be ascertained about Capri. Mr. Trower apparently has distrusted his own unaided capacity to compose an attractive work, and therefore he has invoked the assistance of others to deal with special subjects, e.g. geology, climate, and the like, while old contributions to *The Field* and *The Gentlewoman* have been requisitioned to expand the book. In his preface the author frankly states that he lays no claim to originality, and that he has drawn his materials freely from other sources and laid before the reader their *ipsissima verba*. The extent to which he has had recourse to this expedient may be measured from a cursory examination of one of the longest and most interesting chapters in the book, viz., the one on "Capri under Tiberius." This chapter occupies twenty-eight pages, and in it we have over forty quotations, some of them more than a whole page in length. The

general and unfortunate result is that the book seems "a thing of shreds and patches," whereas in reality it is the result of much patient, laborious and successful study and research by a writer who brings to the consideration of his subject plenty of experience and enthusiasm. As such we commend it to the perusal of all who contemplate a cruise in the Mediterranean or a tour in Southern Italy.

The Aran Islands. By J. M. SYNGE. With 12 Drawings by JACK B. YEATS. Dublin: Maunsell and Co., Ltd. 1907. *Price 5s. net.*

The Aran Islands lie in Galway Bay and are chiefly visited by travellers in search of antiquities, whether in stones or language. But it is with the people chiefly that Mr. Synge is concerned, and this book partakes of their dreamy inconsequent nature. A fairy tale is followed by the description of an eviction; the local nomenclature is discussed or the applicability of ordinary rules of justice to such minds as these; and all through the book are scattered finely drawn word-pictures of sunsets, of funerals, of the joys and terrors of the canvas curagh and so forth. The life of some of the natives is designated as "perhaps the most primitive that is left in Europe." Mr. Synge's sympathetic writing will enhance the interest now being taken in the Erse, and the book is the gainer by characteristic work from Mr. J. B. Yeats's pencil.

ASIA.

Cook's Handbook for Palestine and Syria. New edition thoroughly revised by Rev. J. E. KANAUER and Dr. E. G. MASTERMAN of Jerusalem. London: Thomas Cook and Son, 1907. *Price 7s. 6d. net.*

For the advantages of safe and comfortable travelling arrangements in Palestine and Syria the public is largely indebted to the enterprise of Messrs. Cook, and it is further indebted to them for this useful handbook which must prove an invaluable companion to the tourist. Some of the maps, such as that of Lower Palestine, leave much to be desired in the way of clearness and legibility.

Under the Absolute Amir. By FRANK A. MARTIN. London and New York: Harper and Brothers, 1907. *Price 10s. 6d. net.*

A note on the title-page informs us that the author was for eight years successively engineer-in-chief to two of the Amirs of Afghanistan, and for part of this time was the only Englishman resident in Kabul. The book contains an account of his experiences there, the tendency being to emphasise anything of a horrible description, and of experiences of this kind there was apparently no lack. Considerable space is given to accounts of the two Amirs under whom the author served, but of matter of directly geographical interest there is not much. The volume is illustrated by photographs and by the author's drawings. The latter are remarkable but hardly beautiful, and display some uncertainty in the matter of perspective. The price of the book seems to us excessive, considering its sketchy nature.

AFRICA.

Cook's Handbook for Egypt and the Sudan. By E. A. WALLIS BUDGE, M.A., Litt.D. Second Edition. London: Thomas Cook and Son, 1906. *Price 10s. net.*

A handbook for Egypt and the Nile embodying the archaeological research of such an authority as Dr. Budge, the Keeper of Egyptian Antiquities in the British Museum, together with the extensive practical travel experience of Messrs. Cook, ought to satisfy all the requirements of the most exacting traveller. Some idea

of the up-to-date completeness of this edition may be realised when it is stated that no less than eighty pages have been added for the description of recent archaeological discoveries.

AMERICA.

Economic Geology of the United States. By HEINRICH RIES, Assistant Professor of Economic Geology at Cornell University. New York: The Macmillan Company. London: Macmillan and Company, Limited, 1905. Price \$2.60.

This volume can be confidently recommended as an excellent elementary treatise on the economic geology of the United States. Special prominence is given to the non-metallic minerals in view of the fact that, in 1903, the value of their production exceeded that of the metallic minerals by one hundred and fifty million dollars (£30,000,000). Among the subjects dealt with are coal, petroleum, building stones, clay, lime and calcareous cements, salts, fertilisers, soils and road-materials, iron, copper, lead and zinc, gold and silver, and minor metals.

The notable feature of the book is the extent and variety of the information which is presented in a condensed and lucid manner. For example in the case of coal, its varieties and a list of proximate analyses are given, the theories of origin are discussed, the structural features met with in the field are illustrated, the various coalfields of the United States and their geological distribution are indicated together with the output in recent years. The chapter concludes with a list of literature relating to the subject. The same comprehensive method of treatment is followed throughout the book.

Another striking feature is the series of maps, vertical and horizontal sections, and the photographs of quarries, pit workings and mining fields, illustrating different branches of economic geology. For educational purposes the volume reaches a high standard of excellence as an elementary treatise.

The Pocket Guide to the West Indies. By ALGERNON E. ASPINALL. London: Edward Stanford, 1907. Price 6s. net.

As a general handbook to the West Indies, Mr. Aspinall's little volume ought to be of great service. It gives a good description of the islands, combined with much practical information for tourists, and is well illustrated with maps and photographs.

From Trail to Railway through the Appalachians. By ALBERT PERRY BRIGHAM, A.M. Boston, New York, Chicago, London: Ginn and Company. N.D. Price 2s. 6d.

This crisply written and interesting manual is from the capable pen of the Professor of Geology in Colgate University, and describes the gradual transformation "from trail to railway" which has taken place in the system of communications within the Eastern United States. In describing the transformation of communications Professor Brigham has much to tell us of historical and biographical interest, and although naturally and justly proud of the dauntless energy, perseverance and fertility of resource of his countrymen, he has wisely refrained from the high-falutin, Hail-Columbia style of writing which is still somewhat popular on the other side of the Atlantic. The little volume is a successful attempt to correlate the history and geography of the Eastern States, and will be much appreciated by the young scholars for whom, we apprehend, the book is intended.

Through the Heart of Brazil. By FREDERICK E. GLASS. London: The South American Evangelical Mission.

This little book contains an interesting description of a journey made by the Rev. Frederick E. Glass at the instance of the British and Foreign Bible Society in a comparatively unknown region of Brazil. Mr. Glass had exceptional qualifications for the task. He had had fourteen years' experience of South America, and had made five such expeditions before this one. Still his new undertaking was fairly formidable, for it implied a journey of something like five thousand miles, much of it over partially explored territory, some of which was inhabited by treacherous and hostile Indians. Moreover, Mr. Glass could count upon it that his evangelistic work was certain to encounter from first to last the bitter opposition of the Roman Catholic clergy who constitute the established church in Brazil. The greater part of the book is in the form of a diary. Mr. Glass and his comrades started from Rio de Janeiro, and traversed by rail the provinces of Rio, San Paulo, and Minas Geraes, arriving at the town of Araguay early in April 1902. Thence they marched to the once fairly prosperous but now almost deserted gold-mining town of Santa Cruz, and thence to Goyaz, which they reached early in June. From there they made their way through the forest to the Araguay River, the boundary of the State of Matto Grosso, crossing which they marched through territory, populated mostly by Indians, to Cuyaba, the capital of the state. Cuyaba, according to Mr. Glass, is the farthest interior port reached by steam navigation in South America, being not less than 2000 miles up the Paraguay river. There they stayed till the middle of September, and then started on the return journey, which was accomplished in river steamers, *via* Corumba, Coimbra, Ascension, Corrientes, Parana, and Rosario to Buenos Aires. From the itinerary we learn a good deal about the hardships which are to be expected in marching through the Brazilian forest, and when one leaves the beaten track; and incidentally we learn something of local conditions and circumstances of places and peoples in South America far removed from the ordinary conditions of civilisation. The book is illustrated with some fairly good photographs.

POLAR.

A travers la Banquise du Spitzburg au Cape Philippe. Par le DUC D'ORLÉANS. Paris: Plon-Nourrit et Cie., 1907.

On p. 99 of the present volume of this *Magazine* we summarised the chief scientific results of the Duke of Orleans' Greenland expedition. The present volume, beautifully and copiously illustrated both with coloured and uncoloured figures, gives a narrative of the journey. As regards the get up of the volume, the chief fault we have to find is that it is impossible to handle it, even with the greatest care, without finding that it promptly falls to pieces, while the paper employed not only gives the book a weight which is very fatiguing, but also, from the glazed surface employed to throw off the text figures, has an unpleasant effect upon the eyes. On the other hand, the printing is very clear and the figures are excellent throughout. The narrative takes the form of a diary, and is written with true French vivacity, as also with that charm of style which seems so much commoner among the French than among ourselves. The note of personality rather than of impersonal science is struck throughout, and we feel that the author was perhaps interested in the natural phenomena experienced in so far as they affected

the mental states of the party rather than in their objective significance. But in a popular account of an expedition there can be no doubt that this is by far the most interesting point of view. In addition to the diary the volume contains various appendices, including an account of the discovery of the east coast of Greenland, a list of the birds and mammals seen on the voyage, one of the soundings made, and so forth. As a bright and lively account of an Arctic journey without any great excitements, but which, despite its short duration, was very successful, we cordially recommend the book.

GENERAL.

Atlas of the World's Commerce: a New Series of Maps, with Descriptive Text and Diagrams. Edited by J. G. BARTHOLOMEW, F.R.S.E., F.R.G.S., etc.
London: George Newnes, Ltd., 1907. Price £1, 1s.

This handsome folio claims the credit of being a pioneer work. But looking at the formidable array of plates, one is tempted to ask, "Is it not at this date both the first word on the subject and the last?" One hesitates to think of the labour which has gone to the compilation of these graphic representations of a most complex matter, and if they cannot settle in one way or another the burning "fiscal question," at all events they supply a vivid and irrefragable treatise on the subject. To stir the interest of readers, we may allude to the titles of some of the 176 pages of plates (many of them double-paged maps and diagrams)—"World—Rainfall, Winds, and Climatic Diseases"; "British Isles—Wealth and Population"; "World—Total British Trade"; "World—Strength of National Navies"; "The Far East—Commercial Routes and Vegetation." Later in the volume there are tables of the distribution of food, mineral and miscellaneous products, and of textile materials. In the last-named the immense extent of the cotton areas in the British portions of Africa is strikingly depicted. Regarding the whole, we feel that there are not many persons who are qualified, even if they think fit, to impugn the accuracy of this solid work of reference.

While the bulk of the volume is occupied with plates and diagrams, with text interspersed, attention should be specially directed to the two articles at the commencement, namely, "An Introduction to Economic Geography," by Mr George G. Chisholm, and "The Commodities of Commerce," by Mr. W. A. Taylor. They strike us as particularly comprehensive and authoritative. The volume is worthy of its editor in all respects, and we may just note, in conclusion, his hearty acknowledgments of the labours of Mr. W. A. Taylor and of certain of his draughtsmen and other assistants. The cost of the book is remarkably low.

The Dawn of Modern Geography. Vol. III. By C. RAYMOND BEAZLEY, M.A., F.R.G.S. Oxford: At the Clarendon Press, 1906. Price 20s.

By the publication of this third volume Mr. Raymond Beazley completes the History of Mediæval Exploration and Geographical Science which he tells us he began in 1895. In a review of vols. i. and ii., which appeared in the issue of this *Magazine* for July 1902, we drew attention to the immense reading, industry, and research which are so obvious in a perusal of these volumes, and of this, the concluding volume, we may remark at once that it is in no way inferior to its predecessors in geographical and historical interest or in literary merit. Indeed, to the great majority of readers the period of history with which Mr. Beazley now deals, i.e. from 1260 to 1420 A.D., will be found much more interesting in many respects than any of the periods referred to in the preceding volumes. It is the

period "from the practical termination of the Crusades to the Council of Constance, from the first true English Parliament to the Battle of Agincourt, from the earlier travels of the elder Polos to the commencement of the Portuguese explorations led by Henry the Navigator." Among the many important epochs of geographical history "there are few of greater importance, of deeper suggestiveness, and of more permanent effect than the century and a half in which we gradually embark upon the oceanic stage of our development. For, in relation to man's knowledge of the earth and his exploration of the same, it is now we reach the end of the overland philosophy of European expansion, it is now that we turn to another element to give us that final triumph which seems denied on *terra firma*."

After a brief introductory chapter Mr. Beazley takes up the subject of the Asiatic travellers, the greatest of whom were the Polos, Nicolo and Maffeo, and above all, Marco, of whom he gives a thoughtful and judicious estimate as "a man of the world and of business, alive to the value of money and material good, interested in all commercial affairs, a careful, albeit rather solemn, observer of new and quaint customs, passionately fond of sport and the chase, and of very liberal, though orthodox mind, a foe of heretics, but an admirer of the Buddha." It is impossible for us within the limits of our space to give even a sketch of the journeys of the Polos, but we refer our readers to the interesting and graphic account given by Mr. Beazley, a perusal of which will confirm his deliberate judgment that Marco Polo's work is "the best survey of the world that Mediæval Christianity has left us; in all the literature of the Middle Ages it is only equalled by that of Ibu Batuta; in spite of its shortcomings, its occasional concessions to legend and romance, the appeal of its *Prologue* is admirably true: *pour savoir la pure vérité des diverses régions du monde, si prenez ce livre et le faites lire*." The successors of the Polos are divided by Mr. Beazley into two classes, viz., missionary travellers, and laymen engaged in commerce, diplomacy, and adventure. Prominent among the missionaries are John of Monte Corvino, who penetrated as far east as Peking; Ricold of Monte Croce, who explored Persia; Jordanus of Séverac, who continued the work of John of Monte Corvino in Bombay and Malabar; Pascal of Vittoria, who chose Eastern Europe and Central Asia as the scenes of his mission; Friar Odoric of Pordenone, who followed in the footsteps of the Polos as far as Peking and profited by their popularity; John of Florence, better known as Marignolli, "a poor old wheezing hound, without repute for eloquence or learning" according to one ecclesiastical opponent, but nevertheless selected by Pope Benedict XII. to head a Franciscan mission to Peking, where they were received with enthusiasm and remained with acceptance for three years. Among the laymen prominence is given to Marino Sanuto the Elder, of Torcello, with his far-reaching projects of the conquest of Egypt and Christian control of the Mediterranean and Indian Seas; Pegolotti of Florence, who composed a merchant's handbook "of supreme value to the traders of the fourteenth century; and to all students of mediæval life, mediæval travel, and mediæval traffic, beyond price"; Clavigo of Madrid, despatched by Henry of Castille to the court of Timur at Samarkhand, where he witnessed the bibulous habits of the monarch and his courtiers, and had the courage to resist the pressing solicitations of Timur's chief sultana, who, like her lord, believed "there could be no true jollity without drunken men"; Schiltberger of Bavaria, captured at Nicopolis, and enslaved first by Bajazet, and afterwards by Timur and his successors, in whose service he wandered through Armenia and the Caucasus to Irak, Erivan, and even to Siberia, thence to the Crimea, Circassia, and Mingrelia, ultimately making his escape near Batum. In this most interesting

chapter a few pages are given to Sir John Mandeville, who is deservedly dismissed as an impostor and plagiarist, whose romance, although it attained an unprecedented popularity, is of no real value.

In his third chapter Mr. Beazley gives a brief sketch of the travels of various pilgrims to the Holy Land, of whom the principal are the Dominican Burchard, William of Boldensel, Ludolf of Suchem, and the Russians, Ignatius of Smolensk and the archimandrite Grethenius. In his introduction to the fourth chapter Mr. Beazley sums up the lesson of his work, so far as it had proceeded, in these words: "From the middle of the thirteenth century to the middle of the fourteenth, Latin Christendom, as we have seen, directs the main stream of its expansive energies upon the direct overland routes to the great centres of Asiatic civilisation and wealth; this continental attack is unsuccessful, alike in trade, diplomacy, and missionary enterprise; but in failure lie the elements of success. Accurate knowledge of the goal aimed at; a realisation of the value of unrestricted access to the distant sources of the most precious wares; some understanding of the weakness of that Golden Orient; a dawning conception of the all-encircling and connecting ocean, and of its function as an aid to human intercourse; an exaggerated but stimulating vision of the Christian communities lying beyond the Islamic zone—in the Indies, in East Africa, and in the heart of Asia; a persistent hope and purpose, with the aid of these natural allies, to found such a Christian dominion as had been attempted, with only temporary success, in the Nearer East; these are among the results of that ubiquitous and sustained energy which had explored the Mongol Empire and the Indies, Persia and Cathay, the Black Sea and the Southern Ocean, from the days of Carpini to those of Marignolli, of Clavigo, and of Schiltberger. And yet one more thing had been gained. A beginning had been made in the right direction; men's eyes had begun to turn to the true path of deliverance." The true path of deliverance was the path of maritime exploration, and in this Italy, or rather Genoa, led the van by the re-discovery of the Canary Islands about 1270 A.D. and by the ill-fated expedition of Ugolino Vivaldi in 1291. Of this enterprise Mr. Beazley remarks: "It is needless to dilate upon the magnificent boldness of the venture of 1291, the result of private enterprise, upon its character as the first distinct effort of Christian Europeans in African coasting Asia-wards, upon its attempt to solve at one stroke the problem which baffled explanation for the next two centuries, or upon its suggestions of future triumph, 'the prophetic soul of the wide world dreaming on things to come'; it is, perhaps, more useful to remark the thoroughness of the whole undertaking—Franciscan missionaries accompanying Italian mariners, warriors, and traders—western religion and western commerce, with the defence of western arms, combining to make the first reconnaissance by a new route upon that Heathendom which John of Monte Corvino and Peter of Zercolongi, in similar alliance, were at this very time invading along the historical 'overland' ways. Still more must we note the primary emphasis on mercantile ambitions; here, as elsewhere, commercial instinct is the mainspring of the most vital and profitable exploration." From this time forward the maritime countries of Europe, Italy, Portugal, Spain, France, begin to send expeditions in quest of a route to India. The English claim to the discovery of Madeira in 1370 is briefly referred to by Mr. Beazley and dismissed as untenable. The fifth chapter deals with "the general commercial activities of the chief European states, the lesser achievements of European merchant-travellers and others, in so far as these contribute to widen the horizon of knowledge or to maintain the more distant outlook of European civilisation during the same period (1260-1420)," and it is pointed out that "it is in mercantile ambitions that we begin to find the motive-

power for permanent European expansion, the source of the most fruitful exploration and geographical description." Here again Venice and Genoa stand out prominent as the most important cities in the work of exploration. Compared with that of Italy the contributions of Spain, France, or England to the work of exploration are inconsiderable.

In his last two chapters Mr. Beazley deals with the geographical theories of the age. After commenting on the marked improvement in general knowledge of the surface of the earth shown by geographical and cosmographical treatises, he takes up "the two outstanding achievements of the Mediæval Renaissance in geographical science, the discovery and employment of a portable mariner's guide, independent of the heavenly bodies, and the gradual elaboration of the first true maps." The compass was well known to the Chinese as long ago as the second century of the Christian era, but it is not till nearly the end of the twelfth century that we first hear of it as in general use among European seamen. Its intermediate history is obscure, and in all probability will never be cleared up. If the history of the development of the mariner's compass is obscure, so also is that of the preparation of accurate maps. On this most interesting subject Mr. Beazley has much to say which well repays perusal. The fact that the portolan mile, *i.e.* the distance-scale which is found in all the portolani, more nearly corresponds with the Catalan league than with any other known mediæval measure is duly weighed by him, but he is of opinion that "the seamen of north-west Italy, and especially of Genoa and Pisa, deserve the chief place in the roll of honour" of those who originated the portolani, the earliest of which, the "Portolano Vesconte," is dated 1311. Mr. Beazley, however, justly points out that the portolano was not the product of any one man or school or decade, and that it was probably the result of a combination of many sketches or charts of isolated portions of the Mediterranean coast. "Many years, probably some centuries, of painfully recorded experience must have gone to create it; the notes, plans, and oral traditions of generations of pilots and captains are certainly to be seen in its results. Nothing in the history of cartography is more significant; at no point, perhaps, is there a more impressive advance in human knowledge than when we pass from the highest designs of the pre-portolan type—designs on the whole quite abreast of Ptolemy's—to that *Carte Pisane* with which opens the great series of the mediæval *peripli*." This volume is illustrated with a number of the most interesting of the portolani. In the last chapter we have brief notices of some non-Christian explorers, amongst whom the famous Ibn Batuta is much the most conspicuous. His record of travel includes visits to North Africa, Southern Russia and Siberia, Samarkhand, Kabul, Delhi, the Maldives, Malaya, Canton, Peking, Mecca, the Western Sudan, Timbuctoo, and the Niger. Not the least remarkable and valuable part of this work is the appendix which gives a list of the leading manuscripts and editions of the principal texts in vols. ii. and iii. It is a striking and convincing illustration of the patient assiduity and industry of Mr. Beazley. For example, we gather from it that of the eighty-five known manuscripts of Marco Polo's work he has personally examined no less than thirty. Last, but not least, there is a very useful index to the contents of all three volumes.

We congratulate Mr. Beazley most heartily on the successful completion of an important work which cannot fail to enhance his well-known reputation as a historian and geographer. These volumes present to us the story of the Middle Ages in a new and interesting light, indicating as they do a spirit of enterprise, widely spread and long sustained in Europe, mixed oddly enough from time to time with a sincere and earnest piety and patriotism, and now and again with love of gain and the sterner motives which are inseparable from competition and

commercial rivalry. They form a veritable mine of interest and information to the student of history and economics as well as to the student of geography, and they should do much to rescue the period of history which they describe from the injustice and obloquy implied in the name of the Dark Ages.

Impressions of a Wanderer. By MANMATH C. MALLIK. London :
T. Fisher Unwin, 1907. Price 5s.

The writer of this book is, we imagine, an Indian gentleman, a Barrister of the Middle Temple, who some time ago published a work on the somewhat abstruse subject of *The Problem of Existence*. Since then, we presume, his experience has widened and his judgment has ripened, and we have now before us the second instalment of his message to humanity; and, to tell the truth, the message now and again is somewhat startling. At times, however, we seem to have heard some of the writer's sentiments in other and older works. For example, in the introduction we are told that "human nature is much the same all over the globe," "travel enables one to observe the action of natural forces in all departments of knowledge and of life," and "physical and mental faculties need rest at times for short intervals"—observations probably profound, but not exactly fresh. Evidently Mr. Mallik is keen to impress on his readers the recondite fact that "variety is the law of nature": to this he recurs on pages 11, 17, 61 and 66 and re-enforces it with wealth of illustration. His first chapter is devoted to the subject of language, and he advocates with remarkable courage and unexpected skill the imposition of a universal language. He sees the difficulties, but does not despair. As a preliminary step he makes the ingenious suggestion that "even if one language cannot be made universal, there seems to be no reason why a Lingual Union, after the example of the Postal Union, may not be brought into existence." Three pages suffice to show that neither French nor German will do as the language of the Lingual Union; so he turns to English, for the success of which, it appears, only a little tact and diplomacy are required.

In his second chapter Mr. Mallik inveighs against the variety of monetary currencies throughout the world, and with an earnestness evidently the result of dearly bought experience he warns the traveller to be on his guard against spurious coins.

Chapter III. deals with "the physical and moral features" of the world, and here we have much deep recondite wisdom in such dicta as "guide-books are indispensable things," "hotels are much the same at every place," "all nature springs from the same source—the four elements, air, earth, fire and water," "it is human to have partialities and dislikes." As the chapter proceeds it is evident that one of Mr. Mallik's dislikes is what he calls the "privileged class," for dealing with which he suggests measures which leave little to be desired in the way of thoroughness. Mr. Mallik is obviously a well-educated Indian gentleman; nevertheless we find him describing his own country, the prosperity of which, notwithstanding recent famines and plague, is the envy of the East, in these words: "In India, the people are supposed to exist for the Government and not the Government for the people"; "the position created by prolonged torpor has rendered India a moral and material plague-spot of mankind, full of peril." "India has the misfortune of having no real ruler. The doctrine of the divine right of kings has been demolished in England and in France, but in its place expansion of Empire has brought into existence the divine right of the 'white' skin, the demolition of which has been commenced by Japan and will have to be

finished by China and India." "Thanks to the noble British teaching of bygone days and to recent events, the struggle against despotism in India has commenced, and will yet have to be consecrated, as in other lands, by deeds of martyrdom and sacrifice." We get a welcome but only a momentary relief, when we find that on the next page Mr. Mallik takes up the less exciting topics of custom-house duties on the frontier and the comforts of railway travelling, but he soon warms to his subject again and denounces freely Germany, Russia, and the United States of America. As a nation we are at present in the throes of re-organising our army and military administration, so we cannot afford to neglect an invaluable hint we receive from Mr. Mallik, who points out that "the German Emperor is believed to be convinced that the Japanese and the Gurkhas fight well owing to the possession of short legs, and to be intent on devising a method for making the German army bow-legged in order to make it invincible in war." We are sure that the patriotism of a Carnegie will anticipate the action of the Kaiser by the offer of a substantial reward to any one who will devise the best system of creating a bow-legged race. In the remaining chapters of his book, Mr. Mallik sets forth his impressions during visits to Norway, Japan, and one or two more countries, but none of these require any special remark.

The "Queen" Newspaper Book of Travel: A Guide to Home and Foreign Resorts.

Compiled by the Travel Editor, M. HORNSBY, F.R.G.S. 1907. Price 2s. 6d.

It is scarcely to be expected that the tourist resorts of the world at large can be adequately dealt with in the compass of one small handbook, a large proportion of which is devoted to advertisements; nevertheless this "Travel Gazetteer," as it may be called, will prove a most useful reference book in planning holiday tours. It is supplemented with tables of world-travel routes and other information for tourists.

NEW MAPS.

EUROPE.

ORDNANCE SURVEY OF SCOTLAND.—The following publications were issued from 1st to 30th April 1907:—Six-inch and Larger Scale Maps.—Six-inch Maps (Revised), full sheets, engraved, without contours. *Sutherland*.—Sheets 30, 40, 42, 49, 51, 55, 62, 66, 69, 87, 88. Price 2s. 6d. each. Full Sheets, heliographed, without contours. *Sutherland*.—Sheets 107, 109, 111. Price 2s. 6d. each. Sheets, 106, 110. Price 2s. each.

Errata.—*Ross and Cromarty*.—Sheets 18A, 27, 52, 64. *Sutherland*.—Sheets 108, 112, published 22nd to 30th March 1907, are "without contours."

1 : 2500 Scale Maps (Revised), with Houses stippled, and with Areas. Price 3s. each. *Edinburghshire*.—Sheets II. 7, 10; VII. 9; XIII. 6, 9, 10, 14; XIX. 1, 2, 6, 8; XX. 5, 9, 10, 12, 16. Sheet XIX. 12. Price 1s. 6d.

Note.—There is no coloured edition of these sheets, and the unrevised impressions are withdrawn from sale.

The following publications were issued from 1st to 31st May 1907:—One-inch Map (third edition), engraved, in outline. Sheets 35, 38, 47. Price 1s. 6d. each.

Six-inch and Larger Scale Maps.—1 : 2500 Scale Maps (Revised), with Houses stippled, and with areas. Price 3s. each. *Edinburghshire*.—Sheets V. 4; VI. 4; VII. 5; XII. 8, 11, 12, 15, 16; XIV. 5, 6, 7, 9, 10, 13, 14, 15; XIX. 3, 4; XX. 2, 3, 6; XXV. 7, 8. Sheet XXV. 11, 12. Price 1s. 6d. each.

Note.—There is no coloured edition of these Sheets, and the unrevised impressions are withdrawn from sale.

GEOLOGICAL SURVEY OF SCOTLAND.—Sheet 17. Scale of 4 miles to one inch. Price, unmounted, 2s. 6d. net. *T. Fisher Unwin, London.*

This sheet, which includes the eastern half of Dumfriesshire and the southern half of Roxburghshire, is reduced from the one-inch maps published in 1904.

BARTHOLOMEW'S PLAN OF LONDON.—In four sections, NW., NE., SW. and SE. Scale 3 inches to a mile. Revised to 1907. Price of each section 1s. paper, and 2s. cloth, mounted. *John Bartholomew and Co., Edinburgh.*

RUSSIA.—Carte de la Russie de l'Europe, tirée du Grand Atlas de Marcks, commencée par M. le professeur E. Petri et achevée et rédigée par M. J. de Schokalsky, Président de la Section de la Géographie Physique de la Société Impériale Russe de Géographie, etc. In 16 sheets. Scale 1:2,000,000. 1906.

Presented to the Society by Colonel Jules de Schokalsky, St. Petersburg.

This new map, which is the most complete general map of Russia apart from the Government survey, reflects much credit on its editor, Colonel Schokalsky, who is mainly responsible for its production. Unfortunately for English students, the lettering is in Russian characters.

AMERICA.

CANADA.—Topographic Map of Canada. Scale 1:63,360, or 1 inch to a mile.

Ontario.—Sheet 4, Grimsby; Sheet 7, Fort Erie. (Department of Militia and Defence, Ottawa, 1907.) *Topographical Section, General Staff, London.*

UNITED STATES SURVEY.—Topographic Sheets on scale of 1:62,500, or about 1 inch to a mile. 1906. Price 5 cents each sheet. (The figures after the name of each State indicate the number of sheets received.) Alabama, 2; Alaska, 2; Arizona, 4; Arkansas, 1; California, 4; Colorado, 3; Connecticut, 1; Delaware, 1; Georgia, 1; Illinois, 1; Kentucky, 2; Louisiana, 1; Maine, 3; Maryland, 3; Michigan, 6; Missouri, 2; Montana, 3; Nevada, 1; New Hampshire, 1; New Jersey, 4; New York, 6; North Carolina, 3; Ohio, 6; Oregon, 2; Pennsylvania, 2; South Dakota, 1; Texas, 1; Vermont, 1; Virginia, 1; Washington, 1; West Virginia, 3; Wisconsin, 7.

United States Geological Survey, Washington, D.C.

NEW ATLASES.

BACON'S ATLAS OF THE BRITISH ISLES, revised according to the latest Ordnance Survey. Containing 124 double-page maps and plans, colonial supplement, index-gazetteer and historical descriptions, tables of population, etc. Edited by G. W. Bacon, F.R.G.S. 1907.

G. W. Bacon and Co., Limited, London.

The hundred and thirty maps and plans in this atlas are of varying merit or demerit, and represent so many different periods and styles in the evolution of British cartography that it can scarcely be called a systematic atlas, but rather a miscellaneous collection of plates, good, bad, and indifferent. The maps are stated to be revised from the latest Ordnance Survey, but, so far as we have examined the Scottish maps, this revision is very far from being up to date—thus in the large-scale sectional maps of Scotland we note the omission of the railways

to Lauder, Cruden Bay, Fort Augustus, Ballachulish, Forfar-Brechin, Brechin Edzell, and many others constructed within the past ten years. This atlas is supplemented with a useful series of general maps of the British Colonies and possessions.

STANFORD'S GEOLOGICAL ATLAS OF GREAT BRITAIN AND IRELAND, with plates of characteristic fossils, preceded by descriptions of the geological structure of Great Britain and Ireland and their counties; and of the features observable along the principal lines of railway. By Horace B. Woodward, F.R.S., F.G.S. Second edition. 1907. Price 12s. 6d. net.

Edward Stanford, London.

In this excellent little atlas Scotland receives extremely scant treatment. The maps in the English part of the atlas were formerly known as *Reynolds' Geological Atlas*, and consist of thirty-one plates of county maps on varying scales; but only two plates on a very much smaller scale are devoted to Scotland, and only two to Ireland. Mr. H. B. Woodward's interesting text describes the geological features of interest in each district, and a series of plates of the characteristic fossils is most valuable for reference.

ATLAS OF CANADA.—Prepared under the direction of James White, F.R.G.S., Geographer. 1906.

Department of the Interior, Ottawa.

The Canadian Government and Mr. White deserve to be congratulated on this most valuable contribution to the geography of Canada, which supplies a want long felt by students, intending emigrants, and others interested in the resources and development of the Dominion. It consists of ninety plates, forty-six of which are coloured maps, and the rest statistical diagrams. The maps illustrate relief of land, geology, minerals, forests, telegraphs, telephones, railways, lighthouses, climate, density of population, ethnography, etc., followed by a series of plans of the principal towns. The diagrams show at a glance a summary of the trade and commerce, distribution of population, agriculture, manufactures, vital statistics, finance, fisheries, railways and other statistics illustrating the progress and development of the country. In addition to the maps and diagrams, there are also statistical tables giving a summary of areas and populations according to the 1901 census. The engraving and printing of the atlas is admirably clear and effective.

ATLAS UNIVERSEL DE GÉOGRAPHIE.—Commencé par M. Vivien de Saint-Martin, et continué par Fr. Schrader. No. 51. Perse, Afghanistan, et Inde Nord-Ouest; Échelle de 1:5,000,000. No. 63. Algérie, Tunisie; Échelle de 1:2,500,000. Price 2 francs each map.

Librairie Hachette et Cie., Paris.

FORMAE ORBIS ANTIQUI.—36 Karten im Format von 52:64 cm., mit kritischem Text und Quellenangabe zu jeder Karte. Bearbeitet und herausgegeben von Richard Kiepert. No. XIII. Peloponnesus cum Attica, mit 6 Seiten Text. No. XIV. Phocis, Bœotia, Attica, Athenae, mit 8 Seiten Text. No. XX. Italiae Pars Media, mit 8 Seiten Text. No. XXI. Roma Urbs temporibus liberae reipublicae. Magna Graecia, mit 4 Seiten Text. No. XXII. Roma Urbs inde ab imp. Augusti aetate, mit 4 Seiten Text. No. XXIII. Italia Superior cum Regionibus Alpibus, mit 11 Seiten Text. Price 3 M. each part.

Dietrich Reimer (Ernst Vohsen), Berlin.

For scholarship and beauty of execution, Kiepert's great classical atlas is a work unsurpassed in any language. These new maps are the latest additions, and represent the most recent results of classical research.

THE SCOTTISH GEOGRAPHICAL MAGAZINE.

OLD SCOTTISH VOLCANOES.

By Professor JAMES GEIKIE, LL.D., D.C.L., F.R.S.

DURING many successive periods volcanoes have played a prominent part in the geological history of Scotland, and it is to them we owe some of the most picturesque features of our country. True, we cannot show groups of well-preserved cones, such as those of the Eifel and Auvergne. So long a time has elapsed since even the latest manifestation of volcanic action in Scotland that the forces of denudation have succeeded in obliterating all the more obvious traces of that action. The lavas and fragmental materials erupted at the surface have, in short, experienced so much erosion that the present configuration of the ground bears little or no resemblance to that of any volcanic region in which igneous action has only recently become extinct. And if this be true of our latest eruptions, it is more strikingly true of those of earlier ages. We can still in many cases point to the centres from which our more ancient lavas and ashes were ejected, but not infrequently this is impossible—the products of volcanic action remain, but the sources from which they came can only be conjectured. Sometimes, indeed, lavas and ashes have alike vanished—their former existence being suggested partly by the presence of old volcanic vents plugged up with igneous rock of one kind or another, and partly by the appearance of more or less numerous sheets, dykes, and veins of formerly molten matter which has obviously cooled and consolidated below ground. In such cases it is clear that considerable denudation must have taken place before such deeply-seated portions of the ancient foci of eruption could have been laid bare, and in the general lowering of the surface all superficial volcanic accumulations have necessarily disappeared. Not infrequently direct evidence of eruptions is entirely wanting, and a

kind of indirect evidence may be all that is forthcoming. Not only may superficial volcanic accumulations have entirely vanished, but the plugged-up vents or funnels, with their associated sheets, dykes, and veins, may nowhere be seen, and yet the geologist may be convinced that before the deposition of certain strata volcanic action must have taken place at no great distance from the district over which those strata were laid down. For example, the basal portions of some great series of strata may be abundantly charged with water-worn fragments of volcanic rocks, which must obviously have been derived from the breaking up of pre-existing masses of igneous origin. Sometimes it is possible to trace the stones in question to their source, but just as often this cannot be done. The rocks underlying the conglomerates with their tell-tale fragments may not yield any evidence whatsoever of volcanic action, yet we may be justified in surmising that after their formation, and before the deposition of the overlying conglomerates, volcanic eruptions must have taken place somewhere in the neighbourhood.

When we reflect that the sedimentary formations of the globe are all of derivative origin—that is, built up out of the ruins of pre-existing rocks—it is obvious that the geological record must be very imperfect, and that of many episodes in the history of the past either no evidence has been preserved, or is not now recognisable. It is not less obvious that the oldest formations of a country, having, as a rule, been most frequently exposed to erosion and changes of all kinds, will usually show a more imperfect record, and be harder to decipher than the formations of later ages. Again, when we remember that movements of the earth's crust of one kind or another have taken place at all periods, and that in many cases, as in Scotland, such movements have resulted in the folding, crumpling, and fracturing of the crust, we cannot be surprised to find that the oldest formations are generally the most disturbed, and their structure the most difficult to unravel. Not only are the ancient rocks of Scotland very much disturbed, but they have undergone numerous complex changes both in texture and structure, whereby their original character has been greatly obscured and often obliterated. It might have been expected, therefore, that the earliest chapters of the geological history of our country are neither so full nor so readily interpreted as those that follow—the history becoming more detailed and more easily comprehended as we proceed from the oldest to the youngest systems.

The oldest rocks of Scotland belong to that primeval stage known as the Archæan, and are confined to the north-west Highlands and the Outer Hebrides. That period is incalculably remote, and its records are so fragmentary and confused that their meaning can be but dimly apprehended. So many æons separate the present from the Archæan—so profoundly has the whole structure of the earth's crust been modified since then, so many geographical revolutions has the Scottish area experienced, so frequently has its configuration been remodelled—that we know practically nothing of the conditions that obtained at the surface in those far-past ages. All that can be affirmed is that many of the Archæan

rocks are of igneous origin, and that their character is such as to lead to the belief that they were not extruded at the surface as lavas, the molten matter having obviously cooled and consolidated below ground. It is not improbable, however, that some at least of the granitoid rocks of Archæan times may represent the deep-seated products of volcanic action—that while they were intruded below, lavas and ashes may have been ejected at the surface. No recognisable traces of such ancient volcanoes, however, have been preserved—the sea-floors or land-surfaces of the Scottish area of Archæan times have apparently wholly vanished, or at least are no longer manifest. Nevertheless, it is not impossible that geologists may yet discover relics of the kind, seeing that elsewhere, as in Sweden, remains of what seem to have been Archæan volcanic eruptions have been detected.

Of much later age than the Archæan, but still of vast antiquity, are the rocks that constitute the major portion of the Scottish Highlands. The relative position of the crystalline schists that lie east and south-east of the Archæan tracts is at present undetermined. We only know that they are much younger than the Archæan, and that they may possibly include rocks of pre-Cambrian, Cambrian, and even perhaps Silurian age. They are as a rule so highly metamorphosed and confused that their precise origin is often obscure, and the absence of fossils prevents their geological position being definitely determined. East of the Great Glen, however, the structure and origin of the rocks in question are more readily deciphered. In that region they appear to consist to a considerable extent of what were originally aqueous accumulations—conglomerates, grits, sandy and argillaceous strata, and occasional limestones. These ancient marine deposits are now much altered, and over wide areas have been changed into crystalline schists. Associated with them are numerous sheets and masses of igneous rock—most of which would seem to be of an intrusive character, that is to say, formerly molten matter which has cooled and consolidated at less or greater depths from the surface. Here and there, however, the rocks in question are suggestive rather of lavas, while certain green schistose rocks occurring in the same series are supposed to represent fine-grained fragmental volcanic ejecta. If the rocks of the east Highlands, therefore, be assigned to pre-Cambrian times, we may be justified in believing that the period of their formation was marked by considerable volcanic activity—numerous flows of lava and much dust and ash having accumulated on the floor of the sea. The precise geological position of the rocks in question, however, is, as already mentioned, quite uncertain. But if submarine volcanoes really existed in the Scottish area in pre-Cambrian times, that would be quite in keeping with the evidence supplied by the presumably pre-Cambrian rocks of Anglesey, the Wrekin, Caer Cardoc, and other hills of the Welsh borders, the Malvern Hills, and Charnwood Forest—in all of which traces of volcanic action have been detected.

Of the succeeding Cambrian period the records in Scotland are somewhat scanty, and such as they are they have hitherto yielded no evidence of volcanic action. We know, however, that considerable

volcanoes existed elsewhere in the British area at that time, more particularly in Wales, and on a smaller scale in the region of the Malvern Hills and in Warwickshire. It must be remembered that it is only in the areas just mentioned that Cambrian rocks crop out at the surface, and that over extensive regions in England they must lie buried under a great thickness of later formations. The same is doubtless true of the Cambrian in Scotland. Could these concealed rocks be exposed we should probably find that volcanoes were more widely distributed during Cambrian times than the available evidence would lead us to infer.

If recognisable Cambrian rocks are only sparingly developed in Scotland, it is quite otherwise with those belonging to the succeeding Silurian period. Strata of that age constitute the larger portion of our Southern Uplands—both Lower and Upper Silurian being represented. The sedimentary rocks referred to consist of marine accumulations, and would appear to have been deposited over the floor of a somewhat shallow sea. Amongst the Lower Silurian strata of the Scottish area we find abundant evidence of volcanic action. Not only do lava-flows and beds of fine fragmental ejecta (tuffs) occur over extensive areas, but now and again we encounter thick masses of coarse “breccia” or “agglomerate”—aggregates of angular and subangular blocks and stones—which have obviously accumulated in the immediate vicinity of volcanic vents. Probably all these eruptions were submarine, but it is not unlikely that many of the volcanoes eventually grew to be subaerial, and that in time numerous volcanic islets may have dotted the Lower Silurian sea of southern Scotland. How much of the Scottish area was occupied by that sea we cannot tell. Probably Lower Silurian rocks lie concealed throughout the whole of the central Lowlands, because they reappear in a narrow belt along the southern borders of the Highlands. It is not improbable, indeed, that some of the crystalline schists of the central Highlands may really be the metamorphosed representatives of the sedimentary and volcanic rocks of the Southern Uplands. Be that as it may, we can hardly doubt that the Lower Silurian sea extended over all southern and central Scotland and a considerable portion of the Highlands. And the evidence supplied by the Silurian rocks occurring along the Highland border shows that submarine volcanoes flourished there just as they did further south.

But copious as are the records of volcanic action in the Lower Silurian of Scotland, they cannot compare with those which are met with amongst the corresponding strata of England, Wales, and Ireland. Numerous volcanoes appeared in the relatively shallow sea by which those tracts were largely covered. In Wales the earliest eruptions of Silurian times were upon a grand scale. It is out of the volcanic materials of that stage that the mountain-masses of Cader Idris, Aran Mawddwy, Arenig, and Moel Wyn have been carved and sculptured. Eventually volcanic action in the Welsh area became less vigorous—only a few volcanoes of no great size appearing here and there. But before the close of the period the subterranean forces again displayed astonishing activity, more especially in what is now north Wales. The lavas

and tuffs then ejected are conspicuously displayed in Snowdon and other heights in the same region.

In the Lake District of north-west England the relics of Silurian volcanoes are not less conspicuous. Eruptions appear to have commenced in that region almost at the dawn of the period, and to have continued without interruption nearly to the close of Lower Silurian times. While it is doubtful whether any of the Welsh volcanoes ever became sub-aerial, there are some grounds for believing that the eruptions of the Lake District were not wholly submarine. Roughly contemporaneous with the Welsh and Cumbrian volcanic rocks are those so well exposed along the eastern borders of Ireland, where there would appear to have existed numerous and often closely contiguous volcanic vents.

The volcanic activity which thus characterised the Lower Silurian period throughout the British area eventually became exhausted. With the extinction of the numerous volcanoes of southern Scotland, the Lake District, Wales, and east Ireland, the effusion of lava and ash on the floor of the Silurian sea practically ceased. Only in the far west of Ireland and in Gloucestershire is there any evidence to show that volcanic action was continued into Upper Silurian times.

In the Scottish area the succeeding Old Red Sandstone period was marked by strenuous and long-continued volcanic action. Some of the more conspicuous hill-ranges of the Scottish Lowlands consist largely of the lavas and tuffs ejected from our Old Red Sandstone volcanoes. Among the ranges referred to are the Sidlaw and Ochil Hills, the Pentlands, and not a few of the hills in south Ayrshire. The Old Red Sandstone strata of Scotland consist of a Lower and an Upper series—in the former of which volcanic rocks attain a great development. The physical conditions under which the strata in question appear to have been accumulated may be very shortly outlined. After Upper Silurian times the Scottish area was converted into dry land. This change was brought about by a great movement of the earth's crust, whereby the floor of the Silurian sea was gradually uplifted and squeezed in a direction from south-east to north-west. In consequence of this upheaval by lateral thrust, the new-born land showed an irregularly wrinkled surface, being traversed from south-west to north-east by parallel ridges and intervening depressions of varying width and extent. The depressions thus formed inland seas or great fresh-water lakes—the margins of which can still be traced more or less satisfactorily, although in many places they have been obscured by subsequent modifications of the surface. It was in these lakes that the Old Red Sandstone strata gradually accumulated. To the several basins in question Sir Archibald Geikie has given distinctive names. The largest lake—"Lake Caledonia"—stretched from what is now our east coast south-westward across Arran and the south end of Cantire into Ireland as far as Lough Erne. It extended, in short, over the whole breadth of the central Lowlands, between the Highlands and the Southern Uplands. The deposits of another basin—"Lake Orcadie"—occupy wide areas in the region of the Moray Firth and the Orkney and Shetland Islands. "Lake of Lorne" is the name given to the basin which includes the Old Red Sandstones of western Argyllshire;

while the area occupied by the Old Red rocks of the Cheviot Hills and Berwickshire is designated "Lake Cheviot." It is needless to say that Lake Orcadie, Lake Caledonia, and Lake Cheviot must have extended east and north-east into regions which are now submerged.

Each of those ancient lakes became the scene of vigorous and prolonged volcanic activity. Eruptions appear to have commenced at a very early stage, and to have persisted in some cases down almost to the close of the Lower Old Red Sandstone epoch. To understand the nature of the conditions under which the volcanic eruptions took place, we must remember that the sedimentary strata with which the igneous rocks are associated give evidence of having been accumulated in relatively shallow water, and yet they attain a great thickness. The thickness of the red sandstones occupying the basin of Lake Caledonia, for example, can hardly be less than 18,000 feet. Obviously this great depth of material of shallow-water origin could only have been accumulated upon a gradually subsiding floor. The bottoms of the basins slowly sank down, but the lakes never attained a profound depth, because sedimentation kept pace with depression—the amount of sand and mud transported from the adjacent high grounds and spread upon the lake-floors effectually prevented over-deepening. It is probable, therefore, that the great crustal movement which brought the topographical features of Old Red Sandstone times into existence was continued during that period—that wrinkling of the crust did not cease when the great lakes appeared, but that the upward folds of the crust continued slowly to rise and the downward flows as slowly to sink. To supply all the material carried down from the contiguous high grounds into the lake-basins implies enormous denudation of the land—the gradual lowering of the latter being compensated by the process of upheaval, just as the filling-up of the troughs was prevented by the continuous sinking of their floors.

The lavas and fragmental ejecta attain in some basins a great thickness. In that of Lake Caledonia they reach not less than 6000 feet. Probably the bulk of these materials was erupted on the floors of the lakes, but here and there the volcanoes would seem to have grown so rapidly as to become subaerial. In Lake Caledonia there appear to have been two chains of volcanoes, both extending in the same general direction—from south-west to north-east. The relics of the northern chain are seen in the Sidlaw and Ochil Hills, in Cantire and Arran, while the southern chain is represented by the Pentland Hills and by numerous heights that extend in the same general direction towards the south-west along the flanks of the Southern Uplands into Ayrshire.

The foci of eruption are in many places recognisable. Sometimes these are occupied by larger or smaller bosses of some crystalline igneous rock; at other times the pipes or funnels are filled with agglomerates or breccias. Now and again also we encounter thick sheets of igneous rock which have obviously cooled and consolidated below ground—denudation having gradually removed the rock-masses underneath which they formerly lay entirely concealed.

Another interesting area of Old Red Sandstone volcanic rocks is that of the Cheviot Hills. These hills consist of a great series of lavas

accompanied by very little tuff. The chief focus of eruption is marked by a boss of granite, which occupies an area of 20 square miles, and rises into the summit of the range. From this granite numerous dykes and veins proceed outwards into the surrounding lavas. Brief mention may also be made of the rocks of St. Abb's Head, which consist of a series of lavas and tuffs, near which we can see the focus of eruption, filled up with angular and subangular fragments and intrusions of crystalline igneous rock.

Volcanic activity, in short, characterised all the great basins in which the Lower Old Red Sandstones of Scotland were deposited—the "Lake of Lorne" and "Lake Orcadie," like the others, had their volcanoes; and it is interesting to note that this was the case also in the south of Ireland, where in the Killarney district lavas and tuffs are associated with strata of Lower Old Red Sandstone age, accumulated under the same geographical conditions as obtained in Scotland.

Volcanic action seems to have died out during Lower Old Red Sandstone times in all the ancient Scottish lakes, with the exception of the Orkney basin, where lavas and tuffs and pipes of eruption indicate the existence of subaqueous volcanoes during the deposition of the Upper Old Red Sandstone. It may be added that there is evidence of at least one considerable volcano having been active in the south-west of Ireland, near Limerick, at approximately the same time.

The Devonian rocks of the south-west of England occupy the same stratigraphical position as the Old Red Sandstones of Scotland, and are probably therefore roughly contemporaneous. But while the Scottish series are of lacustrine origin the Devonian strata have been accumulated in the sea. Associated with these marine deposits occur lavas and ashes, showing that volcanic action supervened in southern England at some stage during the vast period of time which separated the close of the Silurian from the beginning of the Carboniferous period. The Devonian submarine volcanoes may therefore have been active at about the same time as the lake volcanoes of Old Red Sandstone times.

The succeeding Carboniferous period was marked especially in Scotland by extensive volcanic action. Eruptions seem to have commenced with the very dawn of the period and to have continued down to the time when the "Coal-measures" began to be accumulated—the "Coal-measures" forming the uppermost division of the great Carboniferous system.

Strata younger than the Carboniferous cover relatively small areas in Scotland, hence it is possible to acquire a fuller knowledge of Carboniferous volcanoes than of the eruptions of earlier periods. Rocks of Carboniferous age may be said to occupy nearly all the low grounds of central Scotland. True, they are often concealed under superficial accumulations of various kinds, but the abundant sections laid bare by streams, rivers, and the sea, together with numerous artificial openings of every kind, have enabled geologists to obtain a clear view of the structure and general character of the great coal-bearing system of strata. The geographical conditions that marked the formation of the Lower Old Red Sandstone were continued, but with many modifications, while the

Upper Old Red Sandstones were being deposited. The great lakes, it is true, had been more or less silted up, and their areas had been also restricted by considerable earth movements, but broad lake basins persisted up to the close of the period.

No hard and fast line separates the deposits of Upper Old Red Sandstone times from the basement beds of the Carboniferous system—the general character of the latter suggesting, however, a gradual passage from lacustrine to lagoon and estuarine conditions. There are few parts of central Scotland in which volcanic action did not manifest itself from time to time during the protracted Carboniferous period. In some regions the eruptions were of relatively short duration, while in other areas they persisted through many long ages. The earlier volcanoes were of a character akin to those of Old Red Sandstone times. Amongst the oldest were those from which the lavas and tuffs in the neighbourhood of Kelso were ejected. The rocks referred to are well displayed in the hills about Stitchell and Smailholm. They occupy a considerable area, extending from Greenlaw in the north to Roxburgh in the south. East of Kelso they are overlaid by younger sedimentary strata, and we cannot tell, therefore, what their range may be in that direction. It is obvious, however, that they must formerly have covered a wide area to the south and west of their present boundary, for dotted over the region in question many old vents are still conspicuous, such as the Dunian, Ruberslaw, Minto Crags, and the Eildons.

But the most continuous stretch of Carboniferous volcanic rocks is that which circles round the north-west borders of the coal-fields of Stirlingshire and Lanarkshire, and forms the Campsie Hills, the Kilpatrick and Kilbarchan Hills, and the broad belt of high ground that extends from Castle Semple Loch to the valley of the Avon, near Strathaven. Belonging, apparently, to the same stage of volcanic activity are the lavas and tuffs of Arthur Seat, and the similar but more abundantly developed volcanic rocks of North Berwick and the Garlton Hills. The plugged-up vents of that region are well represented by the Bass Rock, North Berwick Law, and Traprain.

All the eruptions referred to are assigned to an early stage of the Carboniferous period, and appear to have taken place on the floors of lagoons and estuaries, but in certain cases the eruptions were submarine, as is shown by the occasional occurrence of sea-shells in fine-grained tuffs. Not a few of the old foci of eruption have been located, as we have seen. Some of these are met with in the very heart of the great lava-fields, others appear near their margins, while yet others lie beyond—separated, it may be, by several miles from the nearest lava-flow. The vents in question frequently form conspicuous hills, which is invariably the case when the material that plugs them is of harder consistency than the surrounding rocks. Sometimes the plug consists wholly of a massive crystalline igneous rock, at other times it is an aggregate of angular and subangular blocks, or the vent may be occupied both by crystalline rock and fragmental materials. From the distribution of these old vents and the trend of the associated lavas and tuffs we gather that ejections took place sometimes from chains or lines of contiguous volcanoes, and

in other cases from irregular groups of cones. Eruptions occurring now here, now there, broad subaqueous plateaux were eventually built up, which it is needless to say must have been much more extensive than the hilly tracts that now represent them.

The later stages of the Carboniferous period in Scotland were marked by a somewhat different type of eruptions—namely, by numerous more or less isolated volcanoes, many of which were of insignificant dimensions. They seem to have resembled the *puy*s of Auvergne. Many were mere cinder-cones from which no lavas were ejected. Others, again, were of more considerable size, and from these not only loose fragmental materials, but more or less numerous flows of lava proceeded. When several such *puy*s were closely associated, their united efforts succeeded in building up broad plateau-like banks, on a smaller scale, however, than the volcanic plateaux of early Carboniferous times. Most of the eruptions now referred to seem to have taken place in lagoons and estuaries or in shallow bays of the sea. Now and again, however, the *puy*s were probably subaerial.

The dominant movement of the crust during the growth and decay of these later Carboniferous volcanoes was one of subsidence, so that the *puy*s which erupted in lagoons or upon the floor of the sea were eventually buried under slowly accumulating sheets of sedimentary materials, and in this manner many of them have been preserved. That the eruptions frequently took place under water is shown by the intercalation amongst the tuffs of fossiliferous shales, etc., and now and again of limestones, containing sea-shells and corals. It is improbable, however, that all the eruptions were subaqueous. Doubtless some of the larger *puy*s which commenced upon the floor of sea or lagoon eventually succeeded in becoming subaerial. Nor is evidence wanting to suggest that not a few volcanoes erupted on dry land, and after their extinction became clothed with coniferous trees, the remains of which often occur abundantly in the tuffs associated with the old vents.

Although in many cases portions of the lavas and fragmental materials ejected from the *puy*s can still be seen surrounding the foci of eruption, yet more usually all traces of the cones have vanished, and all that remains to mark the sites of the volcanoes are the plugs of igneous rock that occupy the “necks” or pipes of eruption.

The relics of these Carboniferous *puy*s often form conspicuous features in the landscape. Fife is especially rich in this respect. The Binn of Burntisland, the Hill of Beath, and the Saline Hills are excellent examples. The Castle Rock of Edinburgh, Binns Hill and Tor Hill in Linlithgowshire, Great Moor, Tinnis Hill, and other similar isolated hills in Liddesdale may also be mentioned.

The earlier and more extensive eruptions of the Carboniferous period had not ceased before the *puy* type of volcano made its appearance, but the latter continued long after the great plateau-eruptions had come to a close. The *puy*s in the east and south-east of Scotland were the first to die out. In Ayrshire and Renfrewshire, however, they remained active down to the beginning of that stage which is represented by the uppermost division of the Carboniferous system, known as the “Coal-

measures," when they finally became extinct. There is nowhere any trace of volcanic action having marked the accumulation of that great series of coal-bearing strata.

During the crustal movements which affected Scotland in post-Carboniferous times, the Carboniferous strata, with their abundant igneous rocks, were folded and fractured, and have subsequently experienced enormous denudation. The backs of the many upward folds have been gradually planed away, and the whole succession of the strata from the lowest to the uppermost stages has thus been exposed. Hence we see not only the lavas and tuffs which have from time to time been ejected at the surface, but the numerous "sills" or sheets and dykes of formerly molten rock which never rose to the surface, but were injected at less or greater depths. Owing to the fact that these igneous intrusions usually consist of much more durable rock than the strata amongst which they occur, they often form well-marked ridges and heights in the Lowlands. Salisbury Crags, Corstorphine Hill, the Lomond Hills, Cult and Cleish Hills are good examples, and many others might be cited. Most of these intrusions seem to belong to that later stage of volcanic activity which was marked by the puy-like eruptions described above.

Elsewhere in the British Islands volcanic action played a subordinate part during the Carboniferous period. There is evidence, however, of submarine volcanoes having existed in England, as in Derbyshire and Devonshire, and in King's County and near Limerick in Ireland.

Overlying the youngest Carboniferous strata in Scotland comes a series of red sandstones, the relation of which to the underlying Coal-measures shows that a vast period of time separates the two formations. The Scottish Carboniferous system, as we have seen, was laid down during a period when the earth's crust in our area was slowly subsiding. The movement may not have been continuous—there may have been long pauses, and these may even have been interrupted sometimes by gradual uplifting. But certainly the dominant movement was one of subsidence. It happened then that while the conditions of sedimentation in the earlier stages were for the most part estuarine, in the later stages the lagoons and estuaries, owing to increasing subsidence, were often largely replaced by more or less open sea, over the floor of which flourished the corals and other organisms whose remains constitute the limestones of the Carboniferous system. But the formation of limestone was frequently interrupted—lagoon and estuarine conditions returning again and again, until finally marine invasions ceased—the whole of the uppermost division of the Carboniferous strata (Coal-measures) having been apparently accumulated in estuaries and lagoons. While many of the coal-seams, which occur as well in the Limestone series as in the Coal-measures, represent old land surfaces—thick jungles and marshy growths—not a few would seem to have been formed in shallow water—estuarine or sea-water as the case may have been. In short, the flora of the period not only covered the broad deltas and lowlands of central Scotland, but even invaded the quiet waters—gigantic, reed-

like trees flourishing abundantly in shallow lagoons and estuaries, over the floors of which much vegetable sludge and slime gradually accumulated.

Great crustal movements supervened eventually, and the geographical conditions of the Scottish area were revolutionised. The old lagoons and estuaries vanished, and were replaced by a wide land-surface, which for a long period of time became subject to denudation. The folded and fractured Carboniferous rocks had consequently experienced much waste before the succeeding Permian strata came to be deposited. These Permian beds, chiefly red sandstones, have only a very limited distribution in Scotland. They occur chiefly in the valley of the Ayr, and in Nithsdale and Annandale. Owing to the paucity of their organic remains, there is some uncertainty as to their precise stratigraphical position, but they probably were deposited during the later stages of the Permian period, and may even pertain in part to the subsequent Triassic period. They appear to have been accumulated in inland lakes or basins, much after the manner of the Old Red Sandstone, but the basins were on a much smaller scale. Nevertheless the Permian strata must formerly have extended far beyond their present limits, for they have obviously suffered much denudation.

Volcanic action, which, as we have seen, had ceased to agitate the Scottish area before the formation of the Coal-measures, and had remained dormant during the vast lapse of time that separated the deposition of these "measures" from the accumulation of the overlying Permian sandstones, again broke out. The volcanoes of Permian times all belonged to the puy-type, and most of them were small. Many, indeed, appear to have been mere tuff- and cinder-cones—the products of one eruption. From some, however, not only fragmental materials but lavas were ejected. Sometimes these puys are disposed along lines of "faults" or fractures, at other times they do not appear to be connected with fractures, but occur scattered about in irregular groups. They are especially numerous in Ayrshire and the east of Fife. As in most cases only the plugged-up "necks" remain, it is often impossible to say whether the puys erupted in water or on dry land. In the valley of the Ayr, however, lavas and tuffs are interstratified with the red sandstones, and the same is the case in Nithsdale, so that it is quite certain that some at least of the Permian eruptions were subaqueous. Bearing in mind that the Permian sedimentary strata were formerly much more extensive, and may well have covered wide areas over which many isolated "necks" are distributed, it is not improbable that these latter may also have erupted on the floor of the ancient basins—their lavas and tuffs, and the sandstones with which they may have been interstratified, having been removed by denudation.

In the east of Fife many old vents occur which have been assigned to the Permian period—although no strata of that age are met with in that region. They closely resemble, however, the corresponding "necks" of Ayrshire and Nithsdale, and like those they are of much later date than the Carboniferous strata they traverse. They often form conspicuous isolated hills, such as Kellie Law and Largo Law, and numerous

examples can be studied upon the shore between Elie and St. Monans, where they have been bared and cut into by the sea.

The denudation which has so greatly affected the Permian rocks of Scotland has in many cases revealed the igneous masses which were injected below the surface, cooling and consolidating there. The best examples of such "sills" occur in Ayrshire, and are especially well developed in the neighbourhood of Dalmellington, not a few of the hills in that district owing their origin to the presence of intrusive masses. Kilmeln Hill may be cited as a good example.

The only certain evidence of Permian volcanic action in England is met with in Devonshire, where lavas and tuffs are interstratified with the red sandstones, but hitherto none of the vents from which these may have come has been discovered.

After the Permian period volcanic action remained for some time dormant. During the preceding period that action had been gradually becoming weaker, and finally a long pause ensued. In Permian times renewed activity was manifested, but on a much reduced scale. Prolonged as was the interval that separated the latest eruptions of the Carboniferous from those of the Permian, it was relatively short as compared with the vast succession of ages that supervened after the Permian, during which the British area remained wholly undisturbed by volcanic action. The enormous sedimentary accumulations of the Jurassic and Cretaceous periods (of which so large a part of England is built up) speak only of quiet deposition in widespread seas. Nowhere do they yield the slightest trace of contemporaneous volcanoes. These systems are very sparingly represented in Scotland, although there is every reason to believe that they must formerly have had a wider extension. It is quite possible, therefore, that considerable parts of the Scottish area may have been overflowed by the Jurassic and Cretaceous seas. But however that may have been, there is no evidence to show that less dry land existed in Scotland during Jurassic and Cretaceous times than during the preceding Triassic and Permian periods. It would seem, in short, as if the major portion of Scotland had remained above water throughout the long Mesozoic era.

The succeeding Tertiary systems are likewise very sparingly represented in the Scottish area by aqueous sedimentary rocks. But, on the other hand, igneous rocks greatly abound and bear witness to excessive volcanic activity. These Tertiary eruptions were on a far greater scale than those of earlier ages, and gave rise to vast plateaux, the shattered and much denuded relics of which are well seen in the Inner Hebrides. The islands of Skye, Canna, Rum, Eigg, Mull, and the adjacent coastlands of Ardnamurchan and Morven consist largely of the rocks in question, and were probably all at one time connected, forming together one great volcanic plateau. Many of the most striking mountains in the west of Scotland have been carved out of these Tertiary rocks. Among them may be named the Cuillen Hills in Skye, the Scur of Eigg, and Goat Fell in Arran.

Distinct phases characterised the eruptions of Tertiary times. The first phase was marked by the wholesale fracturing and fissuring of the

crust, by the rise of molten matter in the clefts thus formed, and its frequent escape at the surface in prodigious floods. The great plateau-basalts of the Inner Hebrides, of Antrim, the Færøe Islands, Iceland, and Greenland all belong apparently to the same geological period, and all alike formerly had a much wider extension. It would seem that in early Tertiary times the whole of the area extending as a broad belt from Greenland to Scotland was underlaid by a vast sea of molten matter, struggling to gain a passage to the surface. The overlying crust, bulged up and strained by the rising fiery tide, was shattered by earthquake shocks, and a multitudinous series of cracks and fissures appeared, up through which in many places the imprisoned molten matter escaped and poured out in many successive streams. The lava appears sometimes to have welled up and overflowed from long lines of fracture, at other times it issued at various points upon such fissures. Indeed, the surface of the growing plateau appears to have been studded with rows of volcanoes, and here and there with more or less isolated or sporadic vents—the pipes of which can still be seen in many places. Lavas chiefly were erupted, but not infrequently loose ejecta of large blocks and smaller rock-fragments and cinders were shot out, and now and again fine dust and ashes. While lavas flowed out at the surface, it often happened that molten matter was injected at various depths below, forming here and there thick “sills” or sheets, with accompanying tortuous veins and dykes. Although the earlier eruptions may in some places have been submarine, yet wherever the base of the volcanic series is exposed it appears to rest upon an old land-surface. Successive floods of lava gradually filled up the valleys and depressions, and eventually covered the hills, thus completely obliterating the topographical features of a wide region, and building up a vast plateau over the buried land. Now and again there were pauses in the volcanic activity, during which, in some places at least, the rocks forming the surface of the plateau were exposed to atmospheric action, and decayed; while here and there pools, lakes, and streams appeared, and a vigorous vegetation clothed the land—the plants being indicative of warm, genial climatic conditions. Hence in time sedimentary deposits accumulated, and in these were preserved relics of that flora. These now form the thin leaf-beds and coals which appear intercalated among the plateau-basalts of Iceland, the Færøe Islands, and the Inner Hebrides.

The evidence would lead us further to believe that the great basaltic plateau, of which the Inner Hebrides are the truncated remains, formerly occupied all the area that separates those islands from the mainland and extended far westward into regions which are now submerged. From the Highlands large rivers made their way across the plateau during the period of its growth, and here and there dug out deep ravines and broader hollows which were subsequently overflowed and buried under younger floods of lava. Nay, even after the plateau-basalts ceased to be ejected the same rivers continued the work of erosion, excavating their channels in the youngest basalts that capped the plateau. Enormous denudation has since taken place, but one of these old river-courses has been singularly preserved in the island of Eigg. The Scur of that

island is the relics of a pitchstone-lava, which occupies the bed of an old river with its gravelly accumulations. The flanks of the ancient valley have been denuded away, and the river-bed with its pitchstone now forms the dominant height of the island. The pitchstone must have come from some small vent in the neighbourhood—the last known to have erupted on the surface of the volcanic plateau—and to the lucky accident of the lava having found its way into a valley we owe the preservation of the ancient river-gravel.

Some time after the accumulation of the plateau-basalts had been completed, the region appears to have been again shaken by earthquakes and traversed by abundant fissures into which molten matter was injected, but there is no evidence to show that any of these fissures communicated with the actual surface. They are now represented by a numerous series of dykes, resembling those of the earlier stage, but being usually smaller and often more tortuous and irregular in their course.

The latest phases of volcanic activity in Tertiary times were marked by the uprise within the plateaux of enormous masses of igneous rock, none of which, however, appears to have actually reached the surface. The earliest intrusions consisted of basic rock, known to geologists as *gabbro*, that rose in great boss-like masses, from which innumerable sheets proceeded outwards, insinuating themselves between the bedded basalts of the plateau. So enormous is the amount of the intrusive matter that the surface of the plateau must have bulged up here and there above these boss-like intrusions.

Of later date than the intrusions of *gabbro* are large and small ones composed of more acid rocks, such as granite, felsite, and pitchstone. Some of the bosses pertaining to this stage are of great extent and now form mountain masses, such as the Red Hills of Skye and the granitic heights of Arran. Like the earlier *gabbro* intrusions, none of these acid rocks reached the surface—they are wholly subterranean in origin, although they may well have influenced the surface of the volcanic plateaux into which they rose, causing it to bulge upwards.

It is quite clear that the latest period of volcanic activity manifested in the British Islands far exceeded in importance any other of which we have evidence. When the formation of the great plateau was completed it is probable that it not only occupied the area between north Ireland and the west Highlands of Scotland, but extended away to the north-west by the Færøe Islands and Iceland, and perhaps even to Greenland. After the cessation of volcanic action subsidence ensued—the plateaux was fractured and rent, and vast segments slowly sank under the waters of the Atlantic. The portions that remained above the sea came in time to be still further lowered by denudation—until in many places the deep-seated bosses of *gabbro* and granite were exposed, and now, owing to their superior durability, these have assumed the character of dominant heights, the basalts which formerly covered and surrounded them having been largely removed. The volcanic islands of the Inner Hebrides are thus mere outliers or remnants of a plateau—the constituent rocks of which formerly attained a thickness of many thousand feet. The plateau-basalts are now restricted to these islands and the adjacent

coast-lands, but it is possible that they may formerly have covered considerable areas in what are now the lowlands of central Scotland. These lowlands are traversed by many great dykes, a few of which have been followed more or less continuously into England. It seems likely enough that some of these may have communicated with the surface, and that lava may have flowed from them. But the whole surface of the land has been so greatly lowered since they were injected, that even if they had emitted lavas these might well have been removed by subsequent denudation. Many dykes, however, did not reach the original surface, but are now exposed owing to the removal of the rocks underneath which they were formerly concealed. Indeed, in our coal-fields not a few have been encountered which die out before the existing surface is reached. The presence of these great dykes, which may occasionally be followed for miles in a nearly straight line, crossing deep valleys and running over considerable hills, implies such enormous denudation of the surface that it is hard to believe that so much rock material could have been removed since Tertiary times. Moreover, there are other geological facts that lead one to doubt whether the dykes referred to have any connection with the eruptions of Tertiary times. Some of them at least would appear to be of Carboniferous age, and the probabilities are that the same is true of many others. But even if it cannot be shown that the Tertiary basalts ever invaded central Scotland, the evidence is overwhelming as to the former existence of a vast volcanic plateau, of which the rocks of Antrim and the Inner Hebrides are the sorely wasted relics.

THE MERGUI ARCHIPELAGO: ITS PEOPLE AND PRODUCTS.

By R. N. RUDMOSE BROWN, B.Sc.

(*With Illustrations.*)

LYING somewhat off the great trade routes and the travel arteries of the East, the Mergui Archipelago has received scant and infrequent attention at the hands of geographers and naturalists. The few casual remarks that are to be found with regard to it in geographical works and books of reference are none too accurate, and the only existing maps (Admiralty Charts 216A, 216B, and 824) are far from reliable. One of the earliest, if not actually the first, record of a visit to the Mergui Archipelago was in 1792 when a certain Captain T. Forrest¹ made a voyage southward from Calcutta in search of suitable sugar-growing countries. He traversed the archipelago, but beyond some quaint diagrammatic panoramas of the islands his book gives little information.

Several writers since then have drawn attention to the peculiar inhabitants of the archipelago, the Selungs, but it is to Dr. John Anderson, late superintendent of the Calcutta Museum, that we are indebted

¹ A Voyage from Calcutta to the Mergui Archipelago, Th. Forrest. London, 1792.

for the fullest published accounts of the islands, their people and natural history. During the early months of this year I was fortunate enough to be able to spend many weeks in the archipelago from its northern to almost its southern limits, and also to visit the group of islands lying to the north of the archipelago in the latitude of Tavoy—the Moskos Islands.

The Mergui Archipelago extends northward through almost five degrees of latitude from $8^{\circ} 30' N.$, and includes an area, roughly speaking, of some 10,000 square miles, in which are fully over two hundred islands of all sizes.

Two large rivers enter the sea in the protection of the archipelago, the Tenasserim River at Mergui, and the Lenya River some 45 miles further south. These rivers, particularly the former, bring down an enormous quantity of mud from the soft shales over which they pass, with the result that they tend to form deltas. It is in fact on the delta of the Tenasserim River that Mergui stands. And as the delta grows outwards towards the islands and in their shelter it tends to fill up the channels between them and the mainland, with a result that the nearer islands become gradually absorbed into the mouths of the rivers and are only separated from one another by narrow creeks and mud-flats. Thus King Island is only separated from the mainland by a single navigable channel, Fells Passage, barely half a mile in width, and a few lesser channels with only one to four fathoms of water in them; Sellore is practically joined to the mainland; and Kisserain Island has only a fathom of water between it and the coast with a scarcely navigable channel between it and Domel Island. Further south where no rivers discharge there is relatively deep water to near the coast.

All the islands from lat. $14^{\circ} 30' N.$ to the Sayer Islands in lat. $8^{\circ} 29' N.$ must be considered together from the point of view of structure, though the northern islands constitute the Moskos group, while the Mergui Archipelago, strictly speaking, extends from Tavoy Island to the Sayer Islands. The islands are almost all lofty, and on the larger of them the ranges invariably run north and south parallel to the mountains of the mainland. A glance at the chart shows the remarkable regularity with which these islands lie in two parallel chains. The innermost series runs from Tavoy Point, through Tavoy, Iron, King, Merghi, Sellore, Julian, Kisserain, Paye, Sir C. Malcolm, Sir Ch. Forbes, and Sir R. Campbell Island to Boyce Head on the mainland. The more western series is longer and the chain is broader, often lying in two lines, but none the less well defined. It seems to start in the Moskos group, then after some seventy miles of relatively deep water reappears in the Doung group, where it divides into two series, the one comprising (to cite only the principal islands) Grant and Ross, Christmas, Parker, Trotter, Money, Domel, Bushby, Sir J. Malcolm, Sir E. Owen, High, Lampi or Sullivans, Sir W. James, Pine Tree, St. Luke, St. Matthew, and the Aladdin Islands. The outer series of this chain from the Doung group southward includes Elphinstone, Lloyds, Courts, Bentinck, the Five Sisters, Clara, the Great Swinton, and Lord Loughborough Islands, whence it passes through the St. Andrews group to the Aladdin Islands. There the two series amal-

gamate and run together through Chance and Middle Islands to terminate in the Sayer Islands. Practically all the important islands of the archipelago lie on one or other of these two great chains. West of them lie a few isolated islands and rocks, again arranged in a series, Kabosa, Tenasserim, Blundell, Sir C. Metcalfe, Bailey, Sargent, Sir Jh. Hayes, Great Western, Torres Island, "Black Rock," and the Twins. The whole archipelago, including the Moskos Island, is well within the 50-fathom line, and the steamer track through the islands never passes over more than thirty fathoms and generally much less. The bottom near the mainland is mud, but further out tends to be sand and rock. Almost all the islands are rocky, and most are "steep-to," all round with the exception of a few shelving sandy beaches, though these are less frequent in the north, and remarkably scarce in the Moskos Islands. There are no coral atolls, but there are one or two low-lying sandy islands of the nature of cays, such as Crichton Island or Bogwo in the Gregory group, and Pine Tree Island.

Sunken rocks and rocks awash abound in many parts of the archipelago, and are by no means all charted. The only parts that are really well surveyed are the approaches to Mergui and the steamer track from Fells Passage between Bentinck and Domel Islands through Forrest Strait. The Admiralty Charts (216A, 216B, and 824) date from 1828, with additions in 1839 and again in 1887: these latter were made by Commander A. Carpenter, R.N., from that famous oceanographical research ship, the *Investigator*: a ship in which I also had the privilege of visiting the archipelago this year. The southern chart (216B) is the least accurate, not having been really completed, and this part of the coast and islands is in great need of a new survey.

The archipelago has been British territory since 1826, when it was made over by treaty with the King of Burma, but in the vicinity of Victoria Point there was for long some uncertainty as to the position of the Burmo-Siamese frontier. The dispute was settled in 1894 by a proclamation placing Victoria Island, St. Matthew Island, the Birds Nest group, and other islands north thereof under British administration. The far southern group of the Sayer Islands are also considered British.

The enterprise exhibited by Siam in erecting two lighthouses in her sphere of the islands is noteworthy. One is a long-established one on Goh Phi Island at the mouth of the Renong River, but it has been heightened several feet this year. The other, a powerful flashing light, is on the dangerous Spiteful Rock north of Saddle Island, which, strange to say, though now two years old, still does not appear on the Admiralty Chart. The traffic into the Pakchan River is not large, and possibly these lights serve little purpose as yet, but as the country is opened up an increasing production of rubber and tin will certainly bring more shipping to the river, and the lighthouses will then be of service.

With regard to the geology of these islands I can only make a few very general remarks. The Moskos group are entirely granitic and rise abruptly from the sea. The Doung group (Elphinstone, Grant Ross, and adjacent islands) is largely granitic also, and so are Sir J. Malcolm and Sir E. Owen Islands further south.

The islands from Warden Island to the Five Sisters, including Bentinck Island, are in the main sedimentary, being composed of much contorted beds of soft shales and sandstones, often showing signs of merging into quartzites. The same is the case with the Gregory group east of Lampi or Sullivans Island. But altogether the geology of the archipelago is very little known and would well repay extended study.

Dense jungle covers all the islands, except the small rocks and pinnacles on which there is no soil nor any possibility of vegetation obtaining a hold. The jungle reaches to the water's edges on the more precipitous islands, but the low-lying and more sheltered ones inshore are often fringed with mangrove. The vegetation on the northern islands is on the whole more dense than on those from Bentinck Island and Domel southward, and another very conspicuous feature of the more northern islands is the great number of blasted trees standing gaunt above the top of the jungle. This is said to have been caused by a cyclone which swept that part of the archipelago a few years ago and killed all the larger trees.

With an annual rainfall of over 160 inches and no absolutely dry season, as rain is liable to fall any day even during the NE. monsoon, it is natural that the forest partakes of the character of the tropical rain forest with gradations towards the monsoon forest (using the terminology of Schimper). It is not as lofty as the typical rain forest, but is evergreen and rich in woody lianas and epiphytes. In the drier and more open places such as at the back of the sandy beaches and on such a "cay" as Crichton Island, a species of casuarina is not uncommon (*C. equisetifolia*). It is this tree which has given the name of Pine Tree Island to a small island south of the Lampi group. The numbers of these trees are rapidly decreasing, as it supplies the favourite timber for firewood and is eagerly cut down for this purpose by the crews of the Government launches when they run short of coal. A few specimens of a species of screw palm (*Pandanus*) and one of *Cycas* are occasionally met with, and rubber (*Ficus elastica*) is said to grow wild on some of the islands; certainly the climate is admirably adapted to it, and planted specimens which I saw at Victoria Point are growing exuberantly. A species of *Dipterocarpus* grows on several of the islands and is in great demand for the resin which it yields.

Plantains, cocoanut palms, and pine-apples do not grow wild but are often found in spots frequented by Selungs or Burmese fishermen.

The jak fruit (*Artocarpus integrifolia*), which is very common on the coast, is seldom seen on the islands, nor are the durian (*Durio zibethinus*) or the mangosteen (*Garcinia mangostana*) except in Selung "gardens."

The fauna of the islands exhibits no very striking characteristics except its apparent poverty. The islands are not "infested by wild animals—tiger, rhinoceros, and deer," as the Admiralty pilot picturesquely states. Dr. John Anderson¹ has entered fully into the animal life of these islands, particularly the Elphinstone group and King Island as it was some twenty years ago. Probably to-day many species are rarer and some extinct in the archipelago. Tigers and rhinoceros are

¹ *Jour. Linn. Soc. London, Zoology.* Vols. xxi. and xxii.

unknown now, though both of them, and especially the former, are numerous on the mainland. A small chevrotain (*Tragulus sp.*) is found on some of the larger islands. Wild pig (*Sus scrofa*) are said to be not uncommon, and the Selungs occasionally hunt them with their dogs. The only really abundant mammals are monkeys, of which two species are found, *Semnopithecus obscurus* and *Macacus cynomologus*. The latter of these is to be seen in large hordes along the exposed muddy shores at low tide collecting its food of crabs and limpets. The former species is frequently met with in noisy parties in the jungle chattering merrily overhead. On one or two islands much-worn dugong skulls and bones gave evidence of this animal's existence in the archipelago. These may have been the "whales" which led Commander Lloyd to give Whale Bay its name in 1837, but more likely they were porpoises which are often to be seen.

Bird life in the archipelago does not strike one by its abundance, although there are well over a hundred species recorded by Dr. Anderson. But many of these are birds of the dusk and most are inhabitants of the jungle, so the visitor who lands only during the day on the fringe of the jungle cannot expect to see many. The most conspicuous birds are the hornbills, whose characteristic scream is to be heard morning and evening as they fly far overhead from island to island. Pigeons, including the Imperial pigeons, are often to be heard in the jungle, and herons are very common on the mud-flats of the islands nearer the mainland. Of the haunts of the swallow who builds the edible nests (*Collocalia esculenta*) I shall speak further on.

Crocodiles are said to be very common in the muddy estuaries and mangrove-lined creeks such as Celerity Passage and a hundred other similar localities: they also appear occasionally at Mergui harbour. Many species of water snakes have been recorded from the archipelago, but they do not seem numerous; one may go for days without seeing a single one except in the huge Burmese fish-traps. Lizards and geckos of brilliant colouring naturally abound. The large turtle (*Chelone mydas*) should be mentioned on account of its commercial value. Among the infinite variety and abundance of fishes one may note especially the huge sting ray (*Raja*) which is hourly to be seen leaping up out of the sea, gleaming in the sunshine, and falling again with a splash. Sharks are numerous and very dangerous: in some particularly infested spots the pearl divers are chary of descending on this account.

Coral reefs are very scarce in the waters of the archipelago; probably the large amount of mud in suspension is detrimental to the growth of the corals. There are none nearer to the mainland than at Bushby Island and High Peaked Island, and the most extensive ones are round about Steep and Eyles Islands, Westminster Hall, and the southern end of Sullivans Island. These coral reefs support their usual rich fauna in striking contrast to the poverty of many of the rocky and almost all the muddy shores. The pearl oyster banks are thickly populated with rich alcyonaria and black corals (*Antipathes arborea* and *A. spiralis*), among which the pearl oysters are none too easy to find.

The principal inhabitants of this archipelago are the sea-gypsies

variously known as the Selungs, Salones, or Chillones, a race of uncertain origin, who are confined to these islands and a few places of resort on the adjoining mainland. Since the archipelago first came within the ken of Europeans this curious race has attracted a fair amount of attention, and various accounts of their mode of life and customs have appeared. In 1882 Dr. John Anderson made a study of these people and collected most records previously published.¹ But it may not be without interest to give here some account of the present state of the tribes and to record a few new developments in their history.

The origin of this race is still a very debated point, but they certainly have Malay affinities rather than Burmese. There seems



FIG. 1.—Selungs, Cantor Island.

to be no ground for the oft-repeated statement that they show Negro relationships.

The Selung is generally below the average size and of a colour varying from light brown to very nearly black, though the former is by far commoner. Their features are very coarse as a rule, and generally distinctly Mongolian, but this again varies very much due to the admixture of Malay, Siamese, Karen, and even Chinese blood.

One of the most aberrant types I saw was the daughter of the head-man of Cantor Island—a maiden with not unpleasing but most decided Mongolian features. Many of the Selungs have facial features that are

¹ The Selungs of the Mergui Archipelago, John Anderson, M.D., F.R.S. London, Triebner and Co., 1890. This work contains a short vocabulary of the Selung languages and several photographs of the race.

curiously reminiscent of those of the Tibetans. Their hair is dark or black, lank, coarse and not curly. The children often have lighter hair, but in their case it is cut short but for a few wisps on the top of the head, and these are frequently almost white at the tips, an occurrence which their parents attribute to the bleaching action of the sea water in which they are continually at play. They seem to arrive at puberty young and to age rapidly, especially the women, who at about fifty appear quite old, but as they keep no record of their ages it is impossible to give the average duration of life. The young women are far from handsome, but the old are veritable hags in their repulsiveness. Decrepit and helpless men and women are never seen: the rough life of continual exposure would ensure their death before reaching this stage. At various times it has been repeated that this race is dying out and will soon be extinct, but from what I saw and heard in the Archipelago and at Mergui I think this is far from likely; in that respect I can concur with Anderson, who believed (1887) there were no reliable grounds for the assumption. Their numbers have been variously estimated. At the time of the British occupation of Mergui (1824) an obvious underestimate of 400 was given; about 1840 Helfer, who in many respects is not a reliable authority with regard to these people, put the numbers at 1000; in 1860 the Deputy Commissioner of Mergui put 1000 as the extreme limit, and in 1880-81 a census—the first enumeration to be taken—found 868 Selungs. The figures given in the *British Burma Gazetteer* in 1880, 3000 to 4000, were certainly far from correct, but I do not think the Selung race to-day can number under 800 to 900 individuals. Children are numerous in the tribe, and with the exception of a certain amount of skin disease, seem to be very healthy and happy. Moreover, in the islands of the archipelago the Selungs have a practically undisputed territory, so that there is little fear that competition with a higher race will crush them, or drive them from this last refuge to extermination, and they are as yet largely free from the evil effects of a superficial civilisation. The race is almost entirely a nomadic one, living in their frail boats and moving about the various islands engaged in their occupation of fishing during the whole north-east monsoon season from September to May. During this fine weather they make no settled encampments, and when they come to shore merely draw up their boats on a sandy beach and spend a night or two there before putting to sea again. On the other hand, the strong winds and rough seas that prevail during the south-west monsoon from May to September compel them to seek a home ashore, and at that season they erect rude dwellings of bamboos and palm leaves upon platforms above sheltered beaches. During these months they subsist on their store of dried fish, a scanty stock of rice and a few fruits, and occupy themselves in making mats from strips of Pandanus leaf—their sole manufacture. Traces of these settlements in the shape of wrecked bamboo platforms and rubbish heaps are very common in the archipelago, especially at Port Maria, Elphinstone Island, Bushby Island, Middle Passage, and Sir Charles Forbes Island.

The Selungs are a timid, unobtrusive people, and generally run away

on the approach of strangers. On more than one occasion when we went ashore to a temporary encampment we saw the inhabitants run for the jungle as we approached, leaving their camp deserted except for a few yelping curs. Sometimes a few of the older people remained, and generally a little coaxing induced the greater proportion of the party to return: on some islands, however, no amount of cajolery would induce the "jungle-folk," as the Burmese call them, to approach. This timidity is most marked in the south of the archipelago, where intercourse with white men and Chinese traders is rare, while the fear of Malay raiders has even to-day good grounds. Among the northern islands one finds less timid bands of Selungs and a greater ease in communicating with them, as frequent visits to Mergui and Burmese fishing-villages have made some of them not only less suspicious of strangers, but also fairly fluent in Burmese.

One generally finds the sea-gypsies cruising about in companies of ten to twenty or more, with five or six individuals and numerous dogs in each boat. These boats, which they manage with marvellous skill, seem on first appearance very frail structures, but they appear to be quite seaworthy. A boat averages in length about 15 to 20 feet, with a beam of 6 to 8 feet. The lower part of the hull is a dug-out carefully fashioned and cut on not ungraceful lines, with a large semi-circle scooped out at bow and stern: this is said by Anderson to be to assist the children in climbing into the boats. It is a characteristic feature that is never wanting. The upper works of the boat are constructed of successive layers of strips of palm stem bound by lianas to one another and to vertical ribs projecting upwards from the dug-out. The seams are then made watertight with a kind of dammar, which is smeared over them. A primitive sort of deck is built on the after part of the boat and round the sides and a large tiller rigged. A rude shelter of palm leaves is constructed over the deck on a bamboo framework, and this is removed entire and carried ashore to serve as a hut when the owners spend a night on the beach. Each boat has a small fireplace of clay two feet square in a box frame just forward of the "cabin." A palm-leaf sail—a square lug—is generally seen, but a few of the boats now have a cloth sail. The rigging is all of rattans. Beyond this the appliances found in a boat are of the simplest description—a few home-made mats, several stout bamboo water-vessels, a clay pot or two, and some broken earthenware, the latter as often as not "made in Germany": while the battered kerosene tin, that invariable precursor of civilisation, is not an uncommon sight. Their tools are of the rudest: an adze and a knife or two, and always at least one three-pronged barbed fishing-spear made of rough iron. All their metal and generally the tools themselves are bought at Mergui or Renong. I also saw on several occasions a more evolved spear of a single prong and of the nature of a harpoon. Both these weapons the Selungs use with great dexterity in fishing, while their miserable adzes and knives are the only tools they possess for boat-building. On a certain occasion when I steamed in a small launch into a bay I discovered three Selung boats on the beach and their owners rapidly retreating into the jungle, with the exception

of two obviously very terrified men who had remained in their boats, and each seated in the stern was awaiting our coming with a fishing-spear in his hand, no doubt intending to grimly defend his scanty property against the "pirates." But on no occasion did these people show the least trace of animosity, and I have never even heard of one of them striking a blow at any human being.

The clothing of the Selungs is of the scantiest, and generally consists of little more for men or women than a cloth round the middle, but



FIG. 2.—Selung Boa

a few women now, no doubt in imitation of the Burmese, cover their breasts. The children rejoice in the absence of all pretence at clothes.

Their food is, naturally, fish in the main, fresh during their normal wandering life, but dried during the wet season; in this latter case it is generally the string ray (*Raja sp.*): but they have other articles of diet as well; green snails (*Turbo marmorata*), oysters of various sorts without a litter of whose shells no Selung encampment is complete; Chitons; the large green turtle—a rare delicacy to them; probably some *bêche-de-mer* (though I have never seen them consume it), the

large clam (*Tridacna*), and some honey and various fruits. They penetrate far into the islands in search of this honey, which is said to be derived from *Apis dorsata*, and no Selung boat is complete without a few dirty bottles full of it. Occasionally here and there on the islands one finds small plantations of fruit-trees which the sea-gypsies visit from time to time, durians, plantains, and pine-apples, and a rare cocoanut-palm or mango-tree; but agriculture, even in such a rudimentary form, is evidently very irksome to the average Selung. Rice they are very fond of but never cultivate, and their only mode of obtaining it is by barter with the Chinese or Malay traders who visit them occasionally, generally to the material and moral detriment of the Selungs. Except with a few near Mergui money seems to have no currency, and barter was the only way in which we could obtain any fruit or honey. They make no strong drink of their own, but are said to eagerly buy it from the traders, though of this I must say I had no evidence; nor did I see anything of their addiction to opium-eating which all writers have mentioned as so widespread a vice among this race. Doubtless a little opium would do them no more harm and as much good as it does to the average Burman coolie, but I saw no Selung who was a victim to the habit of taking it. Often during my cruise through the waters of the archipelago I had been told by various Burman and Manilla divers of Cantor Island and its Selung village and cultivations, but it was only shortly before leaving that I was able to visit this place, and certainly it was most interesting. Cantor Island lies not far from Mergui, perhaps thirty miles by the shortest route through the creeks, which would generally be available for the Selung boats, and it is in full sight of the two or three steamers that weekly pass it some three miles away *en route* for Victoria Point or Penang: this the settlers say gives them confidence that they will not suffer at the hands of the Malay marauders, whose depredations are still not unknown in the southern and more remote waters. The island has an area of about one to two square miles, which has been completely cleared of jungle by the efficacious and satisfactory method of firing it. On the eastern—that is, the sheltered—beach a row of ten or twelve comparatively substantial houses has been built. Each house is raised above the beach on a platform of poles, and contains three to five small rooms. The walls and partitions are of palm leaves and the roofs of the same material. The method of utilising these leaves is as follows:—A long thin stick is taken, and over this the palm leaf is bent double and a wooden skewer run through it: about twenty leaves are thus fastened on each stick overlapping one another, and these sticks are then fastened one above the other to form the walls of the house. Most of the houses contained a store of dried fish and a large number of cotton pods, and in one—the headman's house—I found a cat, the only one I saw among the Selungs. Below the houses, where the stench is never very mild, was the usual litter of empty valves of the window-pane oyster (*Placuna placenta*). The plantations are extensive, and consist of several acres of plantains and pine-apples, a few cocoanuts and some mangosteens, as well as the cotton-tree (*Bombax malabaricum*). A fair number of fowls were to be

seen. This settlement is permanent, and contains some forty to fifty people during the dry season and more than double during the wet season. The headman, a finely-built vigorous and intelligent man of about forty, is the acknowledged chief of the settlement, and all bartering with the Chinese traders is done through him, and he himself as well as many of his subjects are frequent visitors to Mergui, where they go sell fruit and oysters in the market, and in consequence many of them speak Burmese with moderate fluency. This is said to be the only permanent settlement of the Selungs in the entire archipelago at present, though there are certain recognised spots where they congregate at times to



FIG. 3.—Selung houses, Cantor Island.

meet the traders, such as the southern end of Lampi, at which place I saw a number of boats collected and a large Malay trading-boat in their midst: that island seems to have been a market-place as far back as 1894, when Mr. F. L. Jardine¹ mentioned it. From time to time it appears that certain Selungs have tried to abandon their roving life and settle down to become agriculturists in addition to fishermen, but circumstances have been too strong for them. In the case of one such attempt on Elphinstone Island which I heard of, Malay raiders swooped down and ravaged it, and this has happened more than once. In 1882 there was a permanent village on King Island called Yimiki (or Yaymyit-gee in Burmese) consisting of several houses,² but I was unable to visit its site, and was told it had been abandoned. Jardine speaks of

¹ Report to the Government of Burma on the Pearl Oyster Fisheries of the Mergui Archipelago, 1894.

² See Anderson (*loc. cit.*), pp. 9-12.

one on Lord Loughborough Island which I am likewise told has been given up. The truth is that probably the roving spirit of these restless sea-gypsies is too deeply ingrained in them to ever allow of their becoming a sedentary people. The nomad rarely becomes an agriculturist: when he does it is by force, and then he seldom survives the experiment. And the sea-gypsies when they have more than once been urged to settle have replied they could never be happy under these conditions and that they have no desire to try them. The case of these people is an excellent example of the physical environment determining the vocation of a race. The islands are in most cases small and steeply inclined, often rocky and always clothed in dense jungle, unless indeed they are merely barren crags; they are in fact as ill-suited as could be for agriculture, while the fear of dacoits never was a negligible factor, and the islands are too small to support much game or many beasts. On the other hand, fish are abundant in the waters of the archipelago, the sheltered channels and creeks offer safety to boats, suitable anchorages and enticing sandy beaches abound and light breezes are frequent, strong winds scarce except in summer—almost ideal conditions for a fishing community. Thus, whatever may have been the vocation of the Selungs in their earlier days in other lands, it was inevitable that in the Mergui Archipelago they should take the line of least resistance and develop into a sea-faring folk. It seems unlikely they will change. It would only be pressure of competition in their fishing-grounds that would be likely to cause them to abandon their nomadic life. That certainly has something to do with the settlement on Cantor Island, and possibly an increasing desire for fruit and rice, taught them by more frequent intercourse with the coastal tribes, might be a factor in such a change, but it will not come for several generations yet.

However, the upward step in social status that the peasant community of Cantor Island has taken is very obvious. These Selungs, who have been here seven years, appear better fed and more vigorous; the want of food is probably not a daily problem for they gather it from both sea and land, and have a sufficiency to store it, and a permanent dwelling in which to do so. It would be of interest to spend long enough among them to be able to compare the moral and intellectual life of these Cantor Island people with that of their primitive nomadic brethren.

As far as could be ascertained by questioning the sea-gypsies themselves and those Burmese and others who come in contact with them, there are, with the exception of the headman on this island, no chiefs among the Selungs and certainly no supreme chief over all. Each boat is a small community in itself, and from what I could gather, a patriarchal community: when several boats go together all the season, doubtless the most experienced graybeard leads. Nowadays they are free from governmental control in any way. Time was when a tax of two rupees a boat was inflicted on them "to inculcate some ideas of responsibility into them" (or words to that effect), but this has fortunately been abandoned long since, largely because the difficulty of collecting it was too great.

It would be superfluous to enter here upon a description of all aspects

of Selung life and activity, but I may refer to a few customs and beliefs that I came across, especially since they seem to vary a little from those given in earlier accounts. They have no marriage ceremony whatever. When a man is able to get his own cooking-pots and mats he goes to ask the father for his daughter's hand, with her assent be it said, and he is never refused. As soon as they can the couple get their own boat, and they are expected to do so after the birth of their first child. In the meantime they live in the boat of the wife's parents. Illegitimate children are very rare. Many deaths are said to occur in child-birth, but as a rule the mother is at work at her daily duties within a few days of the birth of her child. There are no medicine men in the tribe and no medicines. The dead are never buried, but are left on a small platform on some tiny island and never revisited. They say "when a man is dead he is no use; therefore put him away," and they seem to have no belief in a spiritual life.

Their religion, if one may so call it, is not a great feature of their lives, and apparently they have only very occasionally in each year any religious ceremony: at other times I doubt if their creed troubles them at all. The belief which they are said to entertain with regard to certain spirits or nâts invading sick people¹ I did not come across, but more than one party said they had "no god, no spirit, no one to pray to." However, on Cantor Island I found three very crude idols in a much neglected condition. In general appearance the idea of each of these was the same, and I will describe the best one. It consisted of a roughly hewn erect plank standing about twelve feet high and crudely ornamented with crosses and lines in black: the summit was capped with a small top roughly inlaid with pieces of mother-of-pearl. About half-way up a horizontal cross-piece was fixed, and towards the top serrated pieces of wood projected outwards and upwards, each ornamented like the upright; small cloth flags waved from the ends of the arms and the top of the figure. The other two idols were smaller, ten and five feet respectively, and were of essentially the same design with slight variations in ornamentation and carving at the top; one was somewhat elaborately inlaid with mother-of-pearl for half its length. According to the headman an annual festival takes place around these idols at the end of the wet season. Chinese traders at that time bring an abundance of spirituous liquor, which is eagerly bought; and incited by this the Selungs dance and riot before the images as many hours as they are able. Then, when they have sufficiently recovered from their revels, they put to sea to begin the season's fishing. Evidently the festival is largely an expression of their joy in being liberated from their shore quarters and enabled to take to their boats for another season. But the significance of the idol I do not know. Anderson speaks of a somewhat similar orgie which he witnessed, at which a spirit called Theedah was invoked. This he considered a strange lingering travesty of Christian doctrines which the Selungs are known to have imbibed from missionaries many years ago. I cannot but think it possible that these idols which I saw are associated with the same long-forgotten teachings.

¹ Anderson, *loc. cit.*, pp. 14-18.

The distribution of the race seems to be somewhat wider now than it has been in the past. All the islands of the archipelago are visited by them, from the extreme southern Sayer Islands to Tavoy Island, where I found a small encampment of them: while on the Southern and Middle Moskos Islands a few traces of them are to be seen, whither probably they come in search of green snail and trocas shell. They visit Mergui in large numbers and are often to be seen in the market-place and streets; I have counted fifteen Selung boats lying off the town at one time. In the south they are said frequently to visit Tongka, the town on Junkseylon Island on the Siamese coast beyond the Sayer Islands.

Poverty even in the possession of the most elementary essentials of life seems to be an ever-present characteristic of these nomadic fishermen, and more than one writer has remarked upon this fact. Living in a luxuriant tropical clime, amid fertile islands, they appear to be for ever hungry and half starved: their shelters in the wet season are utterly inadequate to protect them; their tools and their household goods are of the meanest description. It seems as if this strange people had never outlived the days when probably they were hunted from the mainland and driven, a despised and downtrodden race, to take shelter amidst these islands. They strike one essentially as a race of outcasts.

In addition to the Selungs the other inhabitants of the islands are not numerous, and most of them are only temporary visitors during the dry season. On several of the larger islands near the mainland, such as Kisserain, Domel and King are small Burmese fishing villages with fairly substantial bamboo and palm-leaf huts built on piles above the mud. In Fells Passage and Celerity Passage these villages are numerous. During the fine season the number of inhabitants is increased and temporary settlements appear. At that season the muddy creeks and channels towards the coast are often alive with Burmese fishing-boats, and almost blocked in places with the palisades of the fish-traps which extend across them. These fishermen are in great contrast to the relatively educated Burmans of the jungle towns, but in physical development they greatly excel the latter. At Port Owen in Tavoy Island—one of the best of the many splendid harbours among the islands—is a settlement of several hundred Karens. They have a native missionary in their midst, who also officiates as schoolmaster, and they all profess Christianity, which, if one might judge from their melodious hymn singing one Sunday afternoon, certainly seems to have taken a strong hold. I had no means of ascertaining whether the doctrines are deeper-rooted than these outward manifestations showed.

Pearling is responsible for a large influx of people to certain parts of the archipelago from September to April, and with the exception of an occasional steamer and a few Chinese junks, the pearling boats are the largest craft to be seen. They stay on the banks for about a month and then return to Mergui to discharge their shell and to renew their stock of provisions. It must not be supposed that these boats work entirely for the pearls: one might rather say that mother-of-pearl shell is what they rely on to pay expenses and perhaps a small profit, while the pearls they find are clear gain.

A few Chinese traders, growing rich off the poor Selungs, some edible-birds'-nest collectors, turtle-egg hunters, and *bêche-de-mer* gatherers complete the population of these scattered islands.

It is worth mentioning here a tradition that was once prevalent in the district as to a former more extensive and civilised occupation of the islands of the archipelago. During my visit I came on no trace of this belief, but Captain R. Lloyd, writing in 1838,¹ speaks of a current Burmese tradition of a former large population who cultivated Lampi (or Sullivans Island) and of the story of a ruined town to be found in its interior. He was unable to verify the existence of this, but from a general appearance of Lampi it does not seem probable that it was ever cultivated, while the interior would seem the most unlikely of places for a town.

However, it is quite certain that the whole province of Tenasserim was more thickly populated some centuries ago than it is to-day. The frequent wars that it was the theatre of some two or three centuries ago and the diversion of the great trade routes to Siam from land to sea have all had a serious affect in depopulating the land.

The productions of the archipelago, though of the usual type of these tropical islands, are not without interest. The nature of the trade approximates very closely to that of most of the South Sea Islands, but is on the whole poorer.

The shell of the mother-of-pearl oyster (*Margaritifera maxima*) must be looked upon as the most important production since it brings in a large return and is responsible for a fleet of about eighty boats which are engaged in fishing it. Each boat contains a Manilla or Japanese diver (rarely a Burmese one), a diver's tender of the same nationality as the diver, and a crew of some five or six Burmans who generally come from Tavoy and neighbourhood for the fishing season. The amount of shell brought into Mergui in recent years has varied from sixty tons to one hundred tons, but as much as 340 tons have been taken in a single season, September to April inclusive. The price of this varies considerably with its quality and the quantity of the world's supply. Last season it generally sold at £85 to £95 a ton at Mergui, and this summer Mergui shell realised £140 a ton in London. Practically the whole of the supply goes to Paris and London.

In former years the Selungs took an active part in this industry, and many of the more expert among them could dive to eight or ten fathoms. Now that the fishing has been generally carried into deeper waters, where naked diving is impossible, the Selungs no longer participate in it to any extent.

The green snail (*Turbo marmorata*) and trocas shells (*Trochus* sp.) are other objects of search, both on account of their mother-of-pearl, and though they are less valuable than the huge pearl-shell oyster, yet they continue to be in great demand in the European shell markets. The right to gather these shells, as well as *bêche-de-mer*, is annually auctioned

¹ R. Lloyd: Mergui Coast Lines and Islands, *Jour. As. Soc. Bengal*, vol. vii pp. 1027-38 (1838).

at Mergui for different parts of the archipelago. The actual fishing is done in shallow water by Selungs, men and women, who collect for the lessees, generally Chinamen. The shell is sold at Mergui at varying prices. This year £40 to £45 a ton was given for green snail, and £18 a ton for trocas—over eighty tons of green snail are often collected in a season, which means about 200,000 shells. Of trocas the quantity is often smaller, but it varies greatly from year to year. *Bêche-de-mer* or trepang collecting is not a very flourishing occupation in the Mergui Archipelago. These holothurians prefer a coral bottom, and coral reefs are not numerous in these waters. However, where they do occur holothurians are to be found in extraordinary abundance, but unfortunately chiefly of a dark red species that has poor commercial value and does not repay the trouble and expense of collection. The more valuable species (known as the teat-fish) are much scarcer and occur in deeper water, but not invariably on coral reefs. The export of *bêche-de-mer* from Mergui each year varies from five tons to twenty tons, valued at about £6 a ton. Practically all this is sent to Penang and Singapore for the large Chinese population at these towns, and very little is locally consumed at Mergui despite the large proportion of Chinamen there.

No copra industry exists on the islands or along the neighbouring coast, and coconut palms are relatively rare and are seldom to be seen in large plantations.

Another Chinese delicacy, the edible nest of the swift (*Collocalia esculenta*), is obtained from certain of the islands, notably the Sayer Islands, the Birds Nest group, St. Matthew Island, Turret Island, Bentinck Island, Kabosa and Tenasserim Islands, parts of Tavoy Island and the Cradle Islands of the Moskos group, as well as certain other small islets and rocks. On the precipitous rocks where these birds choose to build their dainty glistening white nests it is no easy task to collect them: only by means of bamboo ladders can most of the places be scaled, but the high prices obtainable for the nests compensates for the difficulty experienced in obtaining them.

The collectors, who obtain the privilege by annual auction at Mergui, visit the breeding-places once a month during the nesting season and remove all the obtainable nests; but despite this wholesale destruction of eggs and young the supply seems to show no sign of diminution. The nests are very valuable, and are sold for twice their weight in rupees, which works out at about ninepence each, or £5 per lb. The whole supply goes to Penang, Singapore, and Hong-Kong. An idea of the amount of these nests obtainable may be got from the fact that for the right to collect them on the Birds Nest group, a cluster of eight or nine small islets, in one season recently a sum of over £1700 was paid.

The eggs of the large turtle (*Chelone mydas*) are eagerly collected on many of the sandy beaches on various islands. The turtles, as is well known, come ashore at night to lay their eggs, which they deposit in a pit in the sand above high water-mark, afterwards shovelling dry sand over them. The egg collectors watch them come ashore and rifle the "nests" as soon as the turtles leave; but even if one is not pre-

sent at the laying there is little difficulty in locating the "nest": the tracks of the turtle and the disturbed sand at once betray it. As many as from two hundred to over three hundred are found in one nest, and some egg collectors whom I came across at the Moskos Islands told me they may get a thousand a night, and have got on occasions thirty thousand eggs in a month, but this is an unusually large quantity. These eggs, which are all consumed locally, sell in Tavoy or Mergui for 3s. 4d. to 3s. 6d. a hundred, and since these particular collectors had only to pay an annual rent of £66, 13s. 4d. (Rs. 1000) for the exclusive rights for the Moskos Islands, their profit should not be small. The expenses entailed are only the cost of a boat, three men, and some provisions.

Honey and beeswax from a plentiful species of bee (said to be *Apis dorsata*) is gathered by the Selungs in the jungle. A certain quantity of the honey is consumed by them, as it forms one of their staple articles of diet; but a large amount finds its way to Mergui every year. During the season three to four tons of honey and one to two tons of beeswax have been exported. A certain quantity of dammar, wood-aloes (from *Aquilaria agallocha*), and some sandal-wood are also brought into Mergui from the islands. Bats' guano is collected on some of the more northerly islands, but this is a minor occupation, and there are no deposits of guano of great extent.

Black coral (*Antipathes spiralis*) always finds a ready market, though the price is never very high. It is often found by the divers, who look upon it as one of their perquisites. It realises from 20s. to 34s. a hundred pieces, but only the stouter three or four feet of the lower end are of any value: the long tapering end is always thrown away. The main use is for bangles and beads, and no diver ashore in Mergui considers his outfit complete without a black coral walking-stick.

The only two manufactures of the islands are torches and mats. The former is in the hands of Burmese, the latter entirely in the hands of Selungs. Kabosa Island is a favourite resort of the torch-makers during the dry season, on account of the abundance of the material to hand in the shape of the essential resin-producing trees (*Dipterocarpus spp.*). This resinous matter is mixed with decayed wood, a little oil is added, and the whole is then bound in a palm leaf: when dry it is ready for use. These torches afford almost the only means of illumination in most houses. In former years each torch-maker used to pay an annual licence of 6s. 8d. (Rs. 5): over two hundred of these licences were usually taken out. Whether the same tax holds now I do not know.

The mats of Selung manufacture are quite simple and very serviceable and constitute their great wealth in trade. They are woven by the women from strips of palm leaf (*Pandanus sp.*), and when completed are each about 10 ft. by 13 ft. A number are used by the Selungs themselves, but quantities find their way to Mergui, and many are re-exported—their value is about 5d. or 6d. each. In 1894-5 over nine thousand of these mats were exported from Mergui.

The town of Mergui itself—"the big town" to the Burmese on the coast and the Selungs of the archipelago—is actually on an island cut off

from the mainland by the Tenasserim River and one of its numerous creeks. It stretches a mile or more along a muddy shore, and rises over the top of a small ridge some 180 feet high and down its further slopes. The effect of the wooden houses and palm-leaf thatch, the glistening white pagoda and the bungalows on the hill-top amid the trees and profuse flowers, give a decidedly picturesque and pleasing view from the anchorage. The town is rapidly spreading jungle-wards, and its population is increasing annually. In the absence of an accurate census in recent years I have estimated the population at not less than 15,000. Of these, probably one-third or more are Chinamen and the rest Burmese and Hindoo, with some Malays and a few Philippino and



FIG. 4.—The main street of Mergui.

Japanese divers and divers' tenders. The Hindoo element is strong, as all the coolies employed for the harder manual work in the town and harbour are from India, as is the usual rule in Burma.

It is essentially the town of the archipelago, and it is to the islands and the water around them that Mergui turns for its livelihood. True, it has one or two flourishing rice-mills and some trade in timber, but these are secondary and only assume importance when the SW. monsoon season shuts the archipelago from view. In the dry season all interest and attention is centred in the archipelago, while the mainland and the jungle are forgotten. And above everything else that the archipelago sends to Mergui it is pearls and pearl shell that hold the first place of importance, and one must remember that before the start of the systematic pearling in 1891 Mergui was a "half-ruined village." Nothing

has so prominent a place in current conversation and interest as pearling. Everywhere it is the staple topic of conversation, while tin and rubber are only beginning to demand a share of attention. There are only some eighty pearling schooners at work belonging to about fifty or sixty owners, but the number of persons employed in these boats, together with the number who handle the shell and pearls ashore, is considerable. Yet this alone would not account for the commanding interest that pearling claims. That is largely due to the element of gambling it entails.

¶ The pearls obtained practically all represent clear profit over working expenses, and they constitute a profit whose size no man can gauge. It may vary from a few pounds to a thousand or more, and is all a matter of chance. Any day a big pearl may be found: then the fortunate owner is the hero of the hour until another and a better find absorbs all attention. This factor of uncertainty is what gives pearling a prior hold in the interest of the population of Mergui.

The history of Mergui, peaceful and forgotten as the town is to-day, has been full of incident and strife. Originally the seaport of the inland town of Tenasserim, it had great importance through the fifteenth, sixteenth, and seventeenth centuries as the great shipping centre of the whole province of Tenasserim. But more than that, it was from Mergui that the shortest route lay into Siam, and the vast and valuable trade of Siam and the East all passed through this town. In consequence of this strategic value Mergui was often in dispute between the rival kingdoms in the Peninsula, and at different times in its history it has been in the hands of Burma, Pegu, and Siam. However, with the advent of larger ships and greater skill in navigation, the highway to the East gradually ceased to be overland across the isthmus and Mergui lost its importance. During the early part of the first Burmese War (1824) Mergui was finally seized by Britain, and in the treaty which followed the close of the struggle the King of Burma ceded "Mergui and Tenasserim, their islands and dependencies."

The other settlements on the coast exhibit little that is noteworthy. Victoria Point, the most southerly in Burma, is simply a small frontier station facing the Siamese state of Renong. It has a good enough anchorage for small vessels, but is not easy of access even in daytime. It is quite possible that with the rapid development of Lower Burma, Victoria Point may become a port of some importance for the export of tin and rubber. At present these commodities are exported from Maliwun, a small mining settlement and Para-rubber plantation nine miles up the Maliwun River, a shallow tributary of the Pakchan River, but the place is only accessible by shallow draught steamers. Across the Pakchan River from Victoria Point is the entrance to the Renong River at which is a small Siamese fishing village. The town of Renong lies some way up the river, but the greater part of the journey must be made by land, for boats can only ascend about a mile. A bar at the mouth prevents any steamer bigger than a launch from entering.

The country northward from Victoria Point to Mergui was the

subject of a paper in this *Magazine*¹ some years ago, and it has not materially changed since.

A few tin mines are to be found at various points up the coast, but there is no settlement of any importance before Bokpyin is reached in $11^{\circ} 16' N$. This is a small village at the mouth of an unnavigable river, and its main occupation is fishing. The population at Bokpyin as well as at Victoria Point is far more Malay and Siamese than Burmese. There is said to have once been, perhaps a century ago, a far more extensive population around this place, and the land, though nearly all overgrown



FIG. 5.—Bokpyin.

now, certainly gives the impression of once having been cleared and cultivated. The vicinity is low-lying and apparently quite well adapted for rice-fields. Following the coast the next settlement is Cheding, some eight or nine miles north of Bokpyin. This fishing village, according to Commander R. Lloyd,² was formed about eighty years ago by the exertions of the then Commissioner of the district with a view to inducing the Malays in the vicinity to settle down and abandon their predatory incursions on the Burmese and Selungs.

From the point where the Lenya River runs into the sea as far as

¹ South Tenasserim and the Mergui Archipelago: Wm. Sutherland, *S.G.M.*, vol. xiv. (1898) pp. 449 to 464. Reference may also be made to H. W. Smyth, *Notes on a Journey to Some of the South-western Provinces of Siam*, *G. J.*, vol. vi. pp. 401-421, and 522-545.

² R. Lloyd, *loc. cit.*

Mergui the coast is edged with many low-lying islands barely separated from the mainland by shallow creeks, and the land is skirted with muddy flats and mangrove swamps. Among these nestle various small fishing villages, but none of any importance, as they are practically inaccessible except to small boats.

North of Mergui the coastline, though fringed by mangroves, is more distinct, and there are a few settlements, though none of any size or importance until Tavoy is reached, some thirty-five miles up the tortuous Tavoy River. This town lies in the centre of a rich alluvial plain and is an agricultural centre. Originally as the meeting-place of peasant and fisherman at the head of the navigable river, it was once of more importance than to-day, but it still has a fair trade by means of Chinese junks which ply between it and the Straits Settlements.

The advent of steamers and deeper draught vessels has, however, caused a new settlement to arise lower down the river, Tsinbyubin, where a great deal of merchandise is shipped and unshipped. There is a large export trade in fruits, mangosteens, durians and bananas and jak fruits and others to Rangoon, for Tavoy marks about the northern limit of mangosteens and durians.

The future of this lower part of the province of Tenasserim, from Mergui southward, undoubtedly lies in rubber and tin. Para rubber is thriving well in many places where plantations have been started, for water is abundant, and in the dry season the trees can easily be irrigated. The less valuable product of *Ficus elastica* grows with astonishing vigour, but there is no call to cultivate it where the more remunerative species will thrive. No doubt in the northern part of the peninsula the north-east monsoon season would prove too dry for rubber, as it does not experience the occasional heavy rains which are liable to occur in the south during that season.

Already large quantities of tin are being exported from Maliwun, Renong, Mergui, and other ports on the coast, and it seems simply a matter of time until the rich production of the Straits Settlements is rivalled by that of Siamese Malay States and Tenasserim. A scarcity of labour and means of transport seem to be the two great difficulties to contend with at present.

In conclusion, I must take this opportunity of expressing my thanks for untiring assistance to Commander W. G. Beauchamp, R.I.M., and the officers of the R.I.M.S. *Investigator*, in which ship I was fortunate enough to visit the Archipelago; to Mr. Metcalfe, Deputy Commissioner of Mergui, and other inhabitants of the town, for much information given with the greatest readiness; and finally to my colleague in the Pearl Fisheries Investigation, Mr. James J. Simpson.

IRRIGATION PROJECTS IN THE UNITED STATES.

Two recent illustrated articles¹ in geographical journals give accounts of the efforts which are being made by the Government of the United States to render useful to man tracts of land which have hitherto been unproductive desert, and illustrate the great changes which are thus being produced in the arid and semi-arid States.

The most important of the recent Acts of Congress affecting irrigation is the Reclamation Act, passed on June 17, 1902. This Act provides that all moneys received from the sale and disposal of public lands in Arizona, California, Colorado, Idaho, Kansas, Montana, Nebraska, Nevada, New Mexico, North Dakota, Oklahoma, Oregon, South Dakota, Utah, Washington, and Wyoming, shall be set apart as a special fund in the Treasury, to be known as the Reclamation Fund, and to be used in the examination and survey for, and in the construction and maintenance of, irrigation works for the storage, diversion and development of waters for the reclamation of arid and semi-arid lands in the above states and territories. The person entering upon lands to be irrigated by such Government works must reclaim at least half of the total irrigable area of his entry for agricultural purposes, and before receiving a patent for his land he must pay to the Government, in ten or less annual instalments, the charges that have been apportioned against the tract. Further, in order to prevent the acquisition of large tracts for speculative purposes, and possible absenteeism, it is enacted that no right to the use of water for land in private ownership shall be sold for a tract exceeding 160 acres to any one landowner, and no such sale shall be made to any landowner unless he be an actual *bona fide* resident on such land, or occupant thereof residing in the neighbourhood of the land. The funds derived from this law have now reached the sum of £6,400,000 sterling, and the annual increment is about £800,000.

The sixteen arid and semi-arid states named above constitute about one-half of the area of the continental part of the United States, or about one million five hundred thousand square miles. Much of this vast area does not require irrigation, and parts of it, owing to engineering and other difficulties, cannot be reclaimed, but it is estimated that it will be possible to irrigate about fifty million acres, in addition to the ten million acres already reclaimed.

Some twenty-four projects are now being undertaken, while thirteen others are meantime in abeyance until these are completed. It is estimated that these twenty-four will add ultimately 3,198,000 acres to the crop-producing region of the United States, while the other thirteen will give an additional 3,270,000 acres.

Some of the projects now under way may be briefly described here.

¹ See "Irrigation in the United States," by Major J. H. Beacom, *Geographical Journal*, April 1907; and also article by C. J. Blanchard in *National Geographic Magazine*, April 1907. See also this *Magazine*, vol. xxii. p. 524.

The Salt River project in Arizona, which involves the construction of a dam across the cañon of the Salt River about sixty miles above the city of Phoenix, will yield about one hundred and seventy-five thousand acres of productive land, and will, it is expected, be completed in 1909. The formation of the dam has necessitated as a preliminary the hewing of a roadway out of the solid rock-wall of the cañon.

The dam which is being constructed across the cañon is only 800 feet long at the top, but rises 284 feet from its foundations. It will hold up more water than the great dam at Assuan, and will create a lake 25 miles long and 2 miles wide. Another project, that of Minidoka in Idaho, has reclaimed a large tract formerly useless and covered with sage-brush. The chief engineering work in this case was a rock-fill dam, which has a height of 80 feet and a length of 625 feet. The dam was completed in 1906, and associated with it is a canal system to be in operation this year. This system is more than 100 miles in length, and will cover 60,000 acres. In 1904 this region had not a single inhabitant, but now there are 4000 persons there, and the land, previously regarded as worthless, is now valued at £8 to £15 per acre.

Another important project is that in the Yakima valley in the State of Washington. The Yakima river has its source on the eastern slope of the Cascade Mountains, and flows in a south-easterly direction until it empties into the Colombia some distance above Walla-Walla. Here various sub-projects are to be undertaken which will be ultimately combined into one system. These comprise canals, ditches, and storage-dams to hold back the flood waters of the river in several mountain lakes. The total outlay will be about two and a half million pounds, and it is estimated that the water obtainable will irrigate about three hundred thousand acres. When irrigated the land is of extraordinary fertility, yielding valuable crops of apples and hops as well as hay. So heavy is the yield that orchard land sometimes realises over £400 per acre.

In New Mexico the very important Rio Grande project has been approved, but meantime work upon it is slow. The principal feature of this project is to be the construction of a huge dam, intended to impound 2,000,000 acre feet of water, which is to be constructed about one hundred miles north of El Paso, Texas. The dam will be 255 feet high, 400 feet long at the bottom, and 1150 feet long at the top. The estimated cost of the whole project will be about one million and a half pounds sterling, and the water will irrigate 180,000 acres. There have been international difficulties with Mexico, but these have now been adjusted. In this region also the fertility is great, and the best results seem to be obtained with small plots and careful and scientific methods. These mean a relatively dense population, and gives hope of combining the best features of both town and country life.

A very interesting project, from the point of view of the engineering difficulties involved, is that of the Uncompahgre valley in Colorado. In this State the Gunnison flows for a considerable distance in a deep cañon, with almost vertical walls of 2000 feet in height. Though there are

no great difficulties in the way of making a lock on this river, it is found that no dam of reasonable height would lift the water to the level of the surrounding lands. But not far away, at a much lower level, lies the Uncompahgre valley, and by building a low dam in the cañon of the Gunnison, and tunnelling through the rock-wall between the two rivers, it is possible to carry the water of the Gunnison into the valley of the Uncompahgre. The tunnel which forms the underground water-way is to be nearly six miles long, and has a cross-section of $10\frac{1}{2}$ by $11\frac{1}{2}$ feet. The work of tunnelling is being carried on with great rapidity, despite various difficulties, such as the occurrence of gas, subterranean springs, and so forth. The combination of the waters of the two streams will irrigate about one hundred thousand acres of very fertile land in the Uncompahgre valley. This valley has a general elevation of about five thousand feet, but owing to the lofty ranges of mountains which surround it the climate is mild and equable. The soil is of unusual fertility and the district is noted for its fine fruits.

In the case of the Milk river project, in northern Montana, close to the international boundary, some difficult international questions are involved. In this region two rivers, the St. Mary's and Milk river, rise in Montana, on the eastern slope of the Rocky Mountains. The St. Mary's is a mountain stream, and on issuing from the mountains it runs north, crosses the boundary line, and finally reaches Hudson's Bay. Milk river is a prairie stream, having its source only a little east of the St. Mary's river, and it also flows north into Canadian territory, but after wandering through that country for about one hundred and fifty miles, it returns to the United States, and its waters finally reach the Gulf of Mexico. It is proposed to build a dam 50 feet high on the St. Mary's river, and to cut a canal across the low divide separating this river from Milk river, and thus divert as much of the water of the former into the latter as might be required for the irrigation of 100,000 acres lying along its lower stretches. As the Milk river is, however, being already used for irrigation purposes in Canada, some difficulty has arisen in regard to water rights.

In southern Oregon and northern California an interesting scheme, known as the Klamath project, is to be carried out. In the Klamath valley there are at present three lakes, Upper Klamath, Lower Klamath, and Tule or Rhett lake. The Lower Klamath is dammed by a natural dyke which is to be cut through, thus draining the lake bed, which will be divided into farms and irrigated. Tule lake receives its entire supply from a river, called the Lost River, which wanders about for 60 miles and finally returns to a point only about six miles from where it started. This river is to be dammed and its waters carried off to irrigate lands lying in the valley; this will cause Tule lake to dry up, and its bed will then be irrigated, and used for agricultural purposes. In all, about 240,000 acres will be brought under irrigation here, and as the engineering questions involved are very simple, the cost will only be about £3 10s. per acre, the lowest estimated cost of any of the Government projects.

The Yuma project will irrigate 85,000 acres lying in Arizona and

California. A great dam nearly a mile long will be thrown across the Colorado river about 12 miles above Yuma. It will have a length up and down stream of 267 feet with a height of only 19 feet, and there will be two canal systems, one on either side of the Colorado, with headworks at opposite sides of the dam. The waters of the canal that has its headworks at the eastern end of the dam will be carried under the Gila river, which flows into the Colorado a few miles below the dam, by a siphon of steel and concrete about 3300 feet long. The reclamation works in the Imperial valley in Colorado have already been dealt with here.

On an average the charges against each acre of reclaimed land work out at about £10, while in addition there is the necessary outlay on buildings, tools, machinery, as well as the cost of seed and water for the first crop. It is thus obvious that farming on irrigated land can only be undertaken by those with some capital as well as with considerable skill. The Government strives so far as possible to minimise the risk of failure by giving expert aid and advice, especially as regards the kinds of plants best fitted for the different types of lands.

The Bureau of Plant Industry keeps a corps of agricultural experts travelling over the globe on the search for kinds of cultivated plants superior to those already grown in the States, or for new plants which might be grown there. When such new plants are received they are sent to experimental stations in such of the States as seem most likely, bearing in view the origin of the plant, to afford suitable soil and climate.

Among the species which have been successfully introduced are the olive from southern Europe, the orange from eastern Brazil, the tomato, the Lima bean and the potato from Peru; also rhubarb, celery, and asparagus. Among the more successful of recent introductions is the durum wheat from southern Europe and Russia, which is found to be well suited to the dry lands of the semi-arid states. This is the wheat from which macaroni is made, and the acreage devoted to its cultivation is increasing so rapidly that it is even hoped that in the future America may be shipping macaroni to Italy. Again, a hardy Swedish type of oats, capable of resisting great drought, has been introduced into Montana, the Dakotas, and the neighbouring lands, and is giving excellent yields. In the colder region of the north-west forms of the Siberian crab-apple have been introduced, also the Vladimir cherry. Alfalfa is also proving very successful, and is valuable in that it is tolerant of lands in which excess of alkali is present. It is hoped that in the near future large areas of lands now useless on this account may be reclaimed. The varieties chosen for this purpose are those grown in the alkali districts of Turkestan and Algeria, while other types have been found capable of resisting the rigorous winters of the north-western prairie states.

For the fertile oases being produced in the lower Colorado valley many plants are available. Such are berseem, the clover of Egypt, the fig-tree of Smyrna, many varieties of date-palm from Egypt and from the oases of Biskra, while a species of alfalfa has been found which on

this rich land will yield six or seven crops in the year, averaging for the whole from ten to twelve tons per acre. But indeed the crops in the irrigated areas seem enormous when the right plants are utilised and the requisite skill is available. In the Yakima valley it is stated that apples may yield as much as £360 worth of fruit per acre. Geographically the various schemes are of interest in view of the great changes which irrigation is producing in what has hitherto been the Great American Desert.

GEOGRAPHICAL NOTES.

EUROPE.

The Ben Nevis Observatory.—In reply to a question put to him in the House of Commons on 1st August, as to whether he was in a position to say if he was able to accede to the request of the Scottish Members of Parliament for a grant to the Scottish Meteorological Society for the purpose of re-opening and maintaining the Ben Nevis observatories, the Chancellor of the Exchequer said the only scheme which had up to the present been placed before him was one under which the whole cost of the re-equipment and maintenance of the observatories would be thrown upon public funds, and to this he did not feel justified in assenting. He was, however, quite prepared to consider the question of renewing the Government grant, which was for many years given to these institutions through the Meteorological Council, provided that an adequate contribution towards their re-establishment and maintenance were forthcoming from other sources.

ASIA.

Expedition to Central Asia.—It is announced that a scientific expedition for the exploration of Central Asia has been organised by the Russian Geographical Society. It will be under the leadership of M. Kozlow, and will leave in October next. The expedition proposes to spend two years in the close examination of Southern Mongolia and the western parts of the Chinese provinces of Kansuh and Szechuen. It is stated that the whole cost of the expedition will be borne by the Czar.

AFRICA.

The Peopling of Algeria.—In the *Revue Générale des Sciences* (8) Professor Bertrand Auerbach gives a critical summary of a recent official publication on the progress which has been made in the peopling of Algeria by persons of French nationality in the period 1871-1906. During this period the official policy has been consistently to encourage French immigrants as opposed to those of other nationalities. At the beginning of the period this work was facilitated by the insurrection of 1871, which gave to the Government a rich windfall in the shape of the confiscated territories of the revolting tribes, while somewhat later

the extensive emigration from the provinces of Alsace and Lorraine seemed to offer abundance of suitable colonists. The National Assembly set apart 100,000 hectares for the use of these emigrants, the ground being allocated under strict regulations having for their object the selection of families likely to settle permanently upon the land, and having sufficient capital to work it. In spite, however, of these precautions, the immigrants were in large part not agriculturists, but workmen and others unaccustomed to country life. The result seems, however, to have been better than might have been expected, for of 1183 families established only 277 had quitted Algeria or disappeared in 1899. On the other hand, of 165 specially selected families, placed in villages by the "Société de Protection des Alsaciens-Lorrains," only 80 remain. At the same times as the inhabitants of Alsace and Lorraine a considerable number of other French immigrants entered the country, so that in the period 1871-1880 the French population increased from 130,000 to 195,000. But in the same period, without any Government aid, the foreign population increased from 115,000 to 181,000. These immigrants consisted especially of Spaniards, Italians, and Maltese, and supplied the labour necessary for the public works. The higher birthrate among these races assures them of numerical superiority, even if the social superiority of the French is assured by the laws governing the acquisition of land. As in similar cases elsewhere, the favoured position of the French by birth or naturalisation has necessitated very elaborate legal machinery, to obviate the risk of speculation in land, and to ensure the actual settling on the soil of the owners. But, while the above represents the official Government policy, the fear of the agriculturists at home that their markets would be menaced by the cereals and wines of Algeria has always acted as a check, and the figures seem also to emphasise once again the reluctance of the French to become permanent colonists. At the end of 1880, after a decade of forward policy, 3891 families of French origin had been established as compared with 4582 Algerians. While all the families established, French or Algerian, show a strong tendency to abandon their land after a period, a marked difference is that while in the case of the Algerians new families are always to be found to replace the old, this is not the case with those of French origin. Thus in 1892 there were 153 purchasers of Government land, and the Administration displayed much satisfaction because the number of French families reached the exceptionally high figure of 38, or one-fourth of the whole. Further, the French colonists are not always suitable, some French communes not scrupling to give false information in order to rid themselves of undesirables, who are then sent as settlers with grants (concessionnaires) to Algeria.

Within the last few years, however, determined efforts have been made to remedy the abuses, and to obtain suitable colonists with the necessary capital and stock. In 1902 land was distributed to 187 French families and to only 106 Algerians; in 1903 the families of French origin established numbered 376 against 160 Algerians. In 1904, however, the Administration ceased the free distribution of land,

which must now be acquired at a fixed price, or by bidding, two-thirds of the lots for sale being reserved for those of French nationality. If the competition for the land under these conditions has not been keen, yet the last two years has added to the population some 455 French families, all possessing some capital.

The total result is that 30 years of sustained effort have added 30,000 French colonists to Algeria.

AMERICA.

Expedition to South America.—A new scientific expedition to the extreme south of South America is being organised by Mr. Carl Skottsberg, one of the members of the recent Swedish Antarctic Expedition, which will leave Gottenberg during this month, and will consist of Messrs. Skottsberg, P. Quesnel, and T. Halle. It will not sail in a ship of its own, but will make use of the ordinary mail steamers and coasting vessels for transport to the scene of operations, and will be equipped for botanical, geological, and meteorological work. Proceeding *via* Buenos Aires and Montevideo to the Falklands, the leader and Mr. Halle will there spend the summer of 1907-8 for the purpose of continuing the researches begun by the Swedish Antarctic Expedition, Mr. Quesnel meanwhile going to Punta Arenas, where he hopes to make an excursion to the Cerro Payne region. On re-uniting at Punta Arenas, the party will, if time permits, make an expedition to the northwards along the Cordillera and round Otway and Skyring waters before winter sets in. This will be spent in the rainy region of the western channels, and in the spring an attempt will be made to reach Lago Fagnano, the party then moving its headquarters to the region of Beagle Channel. It is proposed to conclude the summer's work with a trip to Tekeenika Bay, returning to Sweden in April or May 1909.

POLAR.

The Scottish Arctic Expedition.—News has been received at the Scottish Oceanographical Laboratory of the arrival of the Scottish Arctic Expedition on board the ss. *Phoenix* at Prince Charles Foreland. Very heavy weather was encountered after leaving the Norwegian coast, and a large quantity of ice exceptionally far to the south and west of Bear Island. This ice continued right up to Spitzbergen. When Dr. William S. Bruce and his companions arrived at Prince Charles Foreland on 11th June they found the country completely covered with snow. The expedition experienced considerable difficulty in landing the scientific instruments, equipment, and stores on account of a perpendicular wall of ice which fringed the coast.

The British Antarctic Expedition.—The *Nimrod*, the vessel of Mr. E. H. Shackleton's Expedition, left the Thames on 30th July, with Lieutenant Rupert England in command. The members of the expedition on board are Mr. James Murray, the biologist; Mr. W. A. Mitchell, surgeon and zoologist; and Mr. A. F. Mackay, the junior surgeon of the

landing party, who will also engage in zoological work. The remaining members of the expedition will join the ship at Lyttleton, New Zealand. These include, besides Mr. Shackleton, Mr. S. Marshall, senior surgeon of the shore party and cartographer of the expedition; Lieutenant Adams, R.N.R., who will be in charge of the meteorological work, and Sir Philip Brocklehurst, for survey work and field geology. Dr. David, Professor of Geology in Sydney University, has arranged to accompany the expedition south to King Edward VII. Land.

Commander Peary's New Expedition.—This explorer's new attack upon the Pole has been postponed for a year owing to some delay in obtaining the new boilers for the *Roosevelt*. Meantime the vessel is to be taken to Etah, Greenland, with the object of establishing a new coal depôt. It is expected to return by the end of September.

The French Antarctic Expedition.—Further particulars are to hand of the plans for Dr. Charcot's new Antarctic expedition. His choice of the same field of exploration as on the former expedition has been made, after due consideration of the plans of other expeditions now being organised or projected, for the following reasons:—(1) the importance of gaining further knowledge of the almost unknown Alexander I. Land; (2) the possibility of the existence in that region of an ice-barrier similar to that of Ross, over the surface of which an advance could be made; (3) the advantages of continuing the scientific work begun by the former expedition, and utilising the experience gained by it; (4) the support to be expected from the Argentine Republic in view of the excellent relations entered upon on the former occasion. The building of a special ship will, it is hoped, soon be begun. The 300,000 francs (£12,000), which the French Government have just asked Parliament to grant in aid of the Expedition, are to be immediately used for its construction. While large enough to permit the carrying out of scientific work under suitable conditions, the vessel will be small enough to enable it to navigate in safety along the coasts and to seek shelter in small coves. In addition to ordinary sledges it is proposed to take motor-sledges for possible use on the surface of an ice-barrier. Wandel Island is to be the final base of operations, and from this the coast of Alexander I. Land will be explored as far as possible, scientific work being at the same time carried on at the base. During the second summer an attempt will be made to navigate westward as far as possible in the direction of King Edward VII. Land. It is expected that the total cost of the expedition will be about £30,000, of which the State is to provide £24,000.

COMMERCIAL GEOGRAPHY.

Railways in Nigeria.—It has been decided to authorise the immediate construction of a pioneer railway of 3 ft. 6 in. gauge, 400 miles long, from Baro, which is the highest convenient point on the perennially

navigable reaches of the Niger, to Bida, by Zungeru, and thence to Zaria and Kano. The work of construction, which will occupy four years, will be begun under the general supervision of Sir Percy Girouard, whose experience in building the desert railway in the Sudan is well known. Full estimates based on regular surveys place the cost of such a line at £3000 a mile, or £1,230,000 in all. In view of the fact that the amalgamation of Northern and Southern Nigeria is approved in principle, and will probably be accomplished in the next few years, the money will be raised as a loan by Southern Nigeria, and will form part of the debt of that colony. The rapidly expanding revenues of Southern Nigeria and its excellent financial position will, in the opinion of the Secretary of State, enable that colony to assume this burden without embarrassment. The new line will enable British enterprise to reach the extensive cotton-growing areas of Northern Nigeria. The intention to construct the Baro-Kano railway will in no way be allowed to arrest or delay the progress of the Lagos railway, which will be steadily continued till it crosses the Niger at Jebba, and ultimately effects a junction with the northern line at or in the neighbourhood of Zungeru.

GENERAL.

Personal.—Our readers will regret to learn of the death of Prof. Angelo Heilprin on July 17, at the age of fifty-four. Professor Heilprin's name has been frequently mentioned in our pages during the last few years in connection with his work on Mount Pelée and the eruption of Martinique, but he led the Peary Relief Expedition in 1892, and is also known as the author of a very useful book on the *Geographical and Geological Distribution of Animals* (International Scientific Series), as well as of various works on geological and other subjects.

EDUCATIONAL.

In the *Bulletin* of the Belgian Geographical Society for the present year (No. 1), M. Jos. Halkin gives an interesting account of the present condition of geographical teaching in the University of Liège, and its development in recent years. The historical account with which the article begins need not detain us here, except merely to note that in Belgium it is thoroughly recognised that the attempt to improve the teaching of geography in schools is doomed to failure unless adequate means are taken for the instruction of the future teachers at the University—a point which it is still necessary to emphasise here. After due consideration, it was concluded that the only means to ensure this was to found a doctorate in geography, the hope being that in course of time the teaching of geography in schools will pass more and more into the hands of these specially qualified persons. The doctorate was only founded in 1900, so that of results it is yet somewhat too soon to speak, but some points in regard to instruction and ideals have their value for us.

The future doctor of geography must pass two examinations, that as

candidate, for which he can go up at the end of two years' study, and that of licentiate, passed at the end of the fourth year, while after these examinations are passed he must present a thesis in order to obtain his degree. If he desire to devote himself to the teaching of geography he must in addition show that he possesses the power of setting forth his knowledge in a publicly delivered lesson. Throughout the course the methodology of geography is taught in addition to its content. The courses in geography are included in the Faculty of Science, and candidates are required to study the elements of the natural sciences as well as mathematics, historical and philosophical science, and so on. In other words, the course is based on the frank assumption, often emphasised here, that modern geography is and should be a means of setting forth the methods and results of science. No clearer proof of this is required than the fact that such an academic subject as zoology is included in the course. It is studied under two heads—first, a general treatment of the different faunas, continental, marine, and so forth; and second, under the head of economic zoology, which deals with animals in so far as they furnish the materials of commerce. The course in physical geography begins with a consideration of the local conditions, and then radiates out from this starting-point. Great stress is laid upon practical work, and in general the account of the course contains much that is valuable in connection with geographical teaching.

A ponderous volume on the *Climatology of the United States* by Professor A. J. Henry, published recently by the United States Department of Agriculture, may be recommended to the notice of teachers as full of interesting matter, and including a great number of useful charts. The second part of the volume gives detailed climatic statistics for certain meteorological stations, while the first part contains a general discussion of the climates of the United States, so written as to form also an introduction to meteorology. Great emphasis is laid on the cyclonic and anticyclonic control of climate, or, in other words, on the chief variations of weather experienced day by day in different localities. An example of a Daily Weather Chart for the States is given, as well as series of small charts, illustrating, for example, the passage of different types of storms across the area. Teachers who are in the habit of giving lessons on British weather will find here abundant material for lessons emphasising the contrasts which the conditions in the States present. The relation of the climates to the physical features of the different parts of the area is also well brought out.

NEW BOOKS.

EUROPE.

A Guide to Zermatt and the Matterhorn: eleventh edition. *A Guide to Chamonix and the Range of Mt. Blanc*: twelfth edition. By EDWARD WHYMPER. London: John Murray, 1907. Price 3s. net each.

These old friends do not require any new recommendation to travellers in Switzerland. Both are kept up to date, and the present editions have notes of

interesting events which have occurred since the publication of the last editions. The note under the heading of Fatalities in the Chamonix volume may be useful as serving to drive home to reckless tourists the dangers of solitary or guideless mountain excursions.

ASIA.

A Handbook of Cyprus. Compiled by Sir J. T. HUTCHISON, M.A., and CLAUDE DELAVAL COBHAM, C.M.G. With Frontispiece and Two Maps. Fifth Issue. London : Edward Stanford, 1907. Price 2s. 6d. net.

This handbook has been revised and brought up to date, the sections on the geology and flora have been modified, and a short note on mythology added. The flora of the island evidently requires fuller investigation, and we recommend it to the notice of botanists desiring new fields to be treated by modern methods.

The Truce in the Far East and its Aftermath. By B. L. PUTNAM WEALE. London : Macmillan and Co., Ltd. New York : The Macmillan Company. 1907.

In our issue for May 1906 we noticed Mr. Putnam Weale's interesting work on *The Reshaping of the Far East*, and now in the volume before us he returns to the subject, and we have as the sequel *The Truce in the Far East and its Aftermath*. Both works are frankly political, and have for their object to enlighten Western public opinion as to the true state of affairs in the Far East. *The Reshaping of the Far East* related the story of China, Korea, Japan and Russia down to the eve of the declaration of peace in 1905. The Treaty of Portsmouth and the Anglo-Japanese Alliance have, according to Mr. Putnam Weale, created a new condition of affairs, which justify, if they do not necessitate, another volume. It may be remarked at once that the sequel contains a good deal of very interesting matter and speculation, but it is somewhat unnecessarily padded with what may now be considered ancient history. The notices of Korea confirm to a great extent the doleful account of that decadent and effete empire given in the masterly work of Mr. Hulbert, *The Passing of Korea*, which we reviewed in May last, and strengthen the contention that, at least for the present, the best thing that can happen to Korea is to undergo a long spell of Japanese tutelage under whatever name the tutelage may be disguised. In this work, as in his former one, Mr. Putnam Weale hardly conceals his dislike or distrust of the Japanese, and his conviction that the peace between Russia and Japan is merely a truce during which both combatants are anxiously preparing for a renewal of the war. But he believes that the war in the Far East in the future will be much affected and complicated by several great changes in the internal condition of China, which is now waking up from the sleep of ages, shaking off its lethargy, and beginning to agitate in a serious way for "China for the Chinese." In the ordinary course of nature the reign of the present aged Dowager-Empress must soon come to an end, and then, if we understand Mr. Putnam Weale aright, there are likely to be violent contests for the succession to the throne. In the meantime, Russia, he is convinced, is "the unbeaten Power," which in 1915 will be ready to renew the struggle for supremacy in the Far East under conditions which will go far to secure its success. It is obvious that within a period of nine years it is hopeless for Russia to expect to recover her supremacy on the Eastern seas, but this weakness, it is contended, will be more than counterbalanced by wholesale construction of strategic railways ; indeed the author's description of the use of

railways in the Russo-Japanese war is one of the most interesting topics in the book. But in a perusal of this book the reader cannot fail to observe that the writer seems to be unaware that Russia nowadays has more than enough to occupy itself with in the rearrangement of its own internal affairs without contemplating or preparing for future wars for a good many years to come. It may indeed be true that the period of nine years still to elapse ere the truce expires is likely to see prodigious changes in China, but it is also true that within the same period equally prodigious changes may take place in Russia—changes of which one result may be that another devastating war in the Far East or elsewhere will be the very last thing the Russian Empire or nation will care to undertake.

Wanderings East of Suez. By FREDERIC COURTLAND PENFIELD. London: George Bell and Sons. New York: The Century Co., 1907. Price 10s. 6d. net.

It was quite superfluous on the part of Mr. Penfield to tell us in his introduction to this work that he had prepared for his travels in the East by "years of sympathetic study of Kipling." Throughout these pages we have plenty examples of the superficiality and flashiness and striving after effect, which are the least effective points of that well-known author's early style, and which in a very short time get wearisome and pall on the reader. But Mr. Penfield writes with a purpose. He claims to be conscientious, and as such "compelled to describe not alone what he saw, but in *clarion notes* tell of some things he failed of seeing; for our country, emerging but now from the formative period, and *destined to permanently lead the universe in material affairs*, is entitled to be better known in the East by its manufactures." The words we have printed in italics indicate the point of view from which Mr. Penfield surveys the East, and more especially China. It is a region of the globe to which the United States have not yet given the proper amount of attention. To his surprise and disgust Mr. Penfield observed that east of Suez the travelling American "fails to see the product of Uncle Sam's mills, workshops, mines, and farms. From the moment he passes the Suez Canal to his arrival at Hong-Kong or Yokohama, the Stars and Stripes are discovered in no harbour nor upon any sea; and may be he sees the emblem of the *great republic* not once in the transit of the Pacific. And the products of our *marvellous country* are met but seldom, if at all, where the American wanders in the East. He is rewarded by finding that the Light of Asia is American petroleum, but that is about the only Western commodity he is sure of encountering in months of travel. This state of things is generally wrong." And he looks for a commercial Utopia where "the genius of our nation should cause our ploughs and harrows to prepare the valley and delta of the Nile for tillage; be responsible for the whirl of more of our agricultural machinery in the fields of India; locate our lathes and planers and drilling machines in Eastern shops in substitution for those made in England or Germany; be responsible for American locomotives drawing American cars in Manchuria and Korea over rails rolled in Pittsburg, and induce half the inhabitants of Southern Asia to dress in fabrics woven in the United States, millions of the people of Cathay to tread the earth in shoes produced in New England, and all swayed to an appreciation of our flour as a substitute for rice—yes, make it easy to obtain pure canned foods everywhere in China and Japan, even to hear the merry click of the typewriter in Delhi, Bangkok, and Peking." As a matter of fact only a small part of the work is given up to the serious object which the writer has in view. The greater part of the book is devoted to sketches of well-known places in the East, *e.g.* Suez, Bombay, Benares, Canton, etc.—sketches

neither better nor worse than those of which we have had a plethora of late. In his last two chapters Mr. Penfield tries his hand at *la haute politique*; in the one he gives a fanciful, à la Kipling perhaps, description of "the Kaiser's play for Chinese trade," and in the other he discusses "Japan's commercial future, and enlarges on the advantage of cultivating friendly relations with the Empire of the Mikado, with the view to supplying it with the raw materials in which Japan is naturally deficient. "The Mikado's Empire is bound to Great Britain by a political alliance of unusual force, but industrial Japan must of necessity be linked to the United States by commercial ties even stronger. Distance between Europe and Japan, and excessive Suez Canal tolls, gave unassailable advantage to the United States as purveyor of unwrought materials to the budding New England of the Far East." The mixture of "Hail Columbia" and diluted-Kipling style may be popular across the Atlantic, and secure for this book a fairly large circle of readers which it is not likely to obtain here.

AUSTRALASIA.

Historical Geography of the British Colonies. Vol. vi. *Australasia.* By L. D. ROGERS. Oxford, At the Clarendon Press. 1907.

This is a well-planned and useful manual. The history of Australia is traced through three stages. The first is the epoch of struggle for existence, the successful close of which is marked by the crossing of the Blue Mountains and by the first attempts at inland exploration. The second period is that of growth and expansion, partly by means of extension—illustrated by the squatting districts of New South Wales—and partly by means of dispersion, that is by means of planting settlements in different and remote places on the coastline, leading finally to the separate existence of South and of West Australia and of Australia Felix or Victoria. Then comes the discovery of gold, serving as a transition to the third period which is marked by the rise of the Labour party, the policy of "Australia for the Australians," and the federation into the Commonwealth.

In the history of New Zealand prominence is given to the cause of the land difficulties with the Maoris, to the influence of Sir George Grey both as Governor and as Premier, and to the contrast yet the similarity between the continental Australia and the island realm of New Zealand which seems as if destined to be the centre of and to give unity to the British Empire of the South Pacific. This leads to the most interesting chapter of the book, the Modern History of the Pacific.

In the more purely geographical part the simplest coral atolls and the groups of the Pacific Islands are taken first, then the semi-continental islands of New Guinea and New Zealand, and finally the continent of Australia. The maps throughout are well-chosen and clear. Little notice, however, is taken either of the Flora or Fauna.

There is only one serious criticism we would venture to pass on a book which serves its general purpose so well. If the metaphors were dropped and the too frequent tags of poetry were omitted there would be a distinct gain in simplicity and in lucidity.

The "Lloyd" Guide to Australasia. Illustrated. Edited by A. G. PLATE for the Norddeutscher Lloyd, Bremen. London: Edward Stanford, 1906. Price 6s. net.

This compact handbook for Australasia, issued by the N.D.L., supplies a want long felt by steamship travellers. We need only add that, as a practical guide-book, the work is really well done, and that the illustrations and maps are excellent.

L'Aurore Australe. Par BLARD D'AUNET. Paris : Plon Nourrit and Co., 1907.
Pp. 402. Price 3 fr. 50.

M. d'Aunet, who officially represented France in Australia from 1893 to 1905, here gives his observations on that country's people and institutions, and the fact that most of the volume has already appeared in the *Revue des Deux Mondes* of September, October and November 1906 proves its high literary quality. The author is extremely frank in his statements, and makes little allowance for the well-known sensitiveness felt by Australians in hearing their country criticised. However, having lived there for twelve years, he is entitled to express his views. His first chapter deals with Australian Society, and he evidently does not think much of it. "The customs of the people are devoid of local colour, the habits of Society seem to be commonplace, and public opinion is governed by paltry questions. . . . Art and Literature have little effect on Australian Society, into which only politicians are beginning to introduce themselves. While the aristocracy of birth does not exist, that of wealth is not rich enough to impose its ideas. Society moves on without aim and without traditions, attached to a routine imported from the Motherland and, lacking initiative, follows a little circle of never-changing amusements. . . . Australia remains very Britannic. It is one of the peculiarities of the Anglo-Saxon mind, like that of Islam, never to modify itself in keeping with new environments. The Englishman follows the same habits wherever he goes, for he has only two ideas of life, the English which is good, and the non-English which is not." M. d'Aunet considers that Australia is "haunted at present by too vast ideas, and is profoundly divided by rival sentiments of particularism, nationality and imperialism. She advances with uncertain steps towards her normal development. Her material prosperity is for years to come dependent on fickle meteorological conditions, and the progress of her affairs is too much subject to the caprices of parliamentary combinations. In spite, however, of these unfavourable symptoms, the Australian nation remains intrinsically healthy and robust." He points out the danger to the Australians of over-devotion to sport, which he declares is their "great business." He considers that to this abuse is due their weakness in secondary education, and he states that the surprising total of £6,000,000 is spent annually in wagers on Australian racecourses. He recognises the high qualities of Australian women, "who can do everything but make a curtsy," and the superior manners of Australian, as compared with French, officials, and he gives an amusing account of the viceregal functions at which he was officially present.

In his second chapter, the author shows the difference between Socialism in Australia and France. While the aim in both cases is the progressive suppression of private property, the Australian idea by its intense patriotism, its according impartial deference to all religious denominations, and its respect for public order, is differentiated from the French. The Labour party in Australia hesitates to accept frankly the name of Socialist, and, wiser than that of France, does not parade its views, but is moderate in its language. As the Australian workman is rarely very poor, he does not see the need of upsetting everything that exists, and while listening calmly to his leaders, he follows them only at a distance. He does not desire to build society on new foundations but simply to improve his own position. He thus obtained not merely the exclusion of coloured immigrants but also of white European artisans, with the result that while immigration into Australia numbered 521,000 persons between 1852 and 1861, it fell to 2400 persons between 1892 and 1901, and between 1902 and 1904 there were 8000 more persons leaving than entering Australia. Alarmed at this, the Australian Govern-

ment is now encouraging the immigration of small agriculturists. Australia is dependent on rainfall, and recent periods of drought reduced her stock of sheep from 100,000,000 to 55,000,000, but since 1903 four excellent years have occurred, and her pastoral and agricultural industries have recovered their former prosperity. It is to the beneficent rainfall, and the consequent prosperity, that the author attributes the serious defeats at the polls which the Labour party has recently sustained.

M. d'Aunet's remaining chapters treat elaborately of the constitution and economic value of Australia, and describe how she is regarded abroad. Looking to her low natality and immigration, he does not expect her population to exceed five and a half millions during the next twenty years. Yet Australia contains everything required for the food of man and for the scientific progress of industry. £16,000,000 worth of gold are annually extracted from her mines. She produces annually in good years £28,000,000 worth of wool, her chief industry, whereof one-half goes to Europe. Her only rival is Argentina, but the latter's wool is not of such fine quality. The total annual value of her pastoral products exported is, on an average, £36,000,000, while that of her rivals exceeds £7,000,000. The financial position of Australia is at present, in the author's opinion, satisfactory, the credit of the country resting on its natural resources, but the weak point in its finances is the excessive proportion of capital borrowed abroad. Yet Australia is determined to have a navy of her own. She has already an army of 24,000 men. The average Australian is satisfied that his country requires no help from without and that everything is better in Australia than anywhere else.

AMERICA.

British North America. I. The Far West: The Home of the Salish and the Déné.

By C. HILL-TOUT. London: Archibald Constable and Co., 1907. Price 6s. net.

This is another volume of the series of which we have already spoken here, dealing with the native races of the British Empire. No subject more deserves attention at the hands of British anthropologists than the life-history of the uncivilised races of the Empire, and it is to be feared that in the past opportunities of study have been lost which in the nature of things cannot recur.

The present volume is one of which we wish to speak in terms of the highest appreciation. It is written in a popular, understandable way, but it gives evidence of a close and prolonged observation of the two races with which it deals. There are altogether ten separate stocks or nations, classified on the basis of their language, in British North America, and the two now dealt with are the Salish and the Déné, who inhabit the extreme north-west—the country which extends practically from the shores of Hudson's Bay to the Pacific Ocean. Both of these tribes are again divided into numerous linguistic groups or divisions, but Mr. Hill-Tout confines himself principally to the common racial characteristics which make up the social life and organisation of a primitive people. Only two points need be noticed here. One is that, unlike the Eastern tribes, neither the Salish nor the Déné races are really warlike. But in all other moral qualities, save that of courage, the Indians of British Columbia rank high. For honesty, hospitality and charity they stand out conspicuously. In this connection Mr. Hill-Tout refers also to their receptiveness, which he says is one of their most striking qualities. "It would be difficult," he says, "to find two peoples more susceptible to foreign influences, more receptive of new ideas, and more ready and willing to carry them out. We assumed a grave responsibility when we undertook to civilise these races."

The second point which may be noticed is that in spite of the just and humane treatment of the native population by the Government and of the fact that wars and disturbances but rarely now occur, the whole native population of the Province scarcely numbers twenty-five thousand in comparison with an estimated population of five times that number during the first half of last century. This would appear to indicate that in a very short period the native races will be extinct. But Mr. Hill-Tout does not take a discouraging view for their future. He regards the present conditions of these native races as more comfortable than the average European peasant, and is of opinion that they are now fast fitting themselves for the conditions of modern civilised life. It is to be hoped that this opinion will prove correct, and that they will form under altered conditions a permanent addition to the races of the Empire. A large number of excellent photographs add value to the book.

Panama: The Isthmus and the Canal. By C. H. FORBES-LINDSAY. Philadelphia: The John C. Winston Co., 1906. *Price 1s. net.*

This is a very interesting little volume, which may be fairly described as a brief history of Panama from the year 1513 A.D., when it emerges into the light of history, and when the fact that it is an isthmus was discovered by the Spanish adventurer, Vasco Nunez de Balboa. The special object, however, of the work is to give the reader a succinct account of the various projects and efforts which have been made from time to time to connect the Atlantic and Pacific oceans at or near Panama by a railway or canal or both. Of these, by far the most important was the ill-fated project of Baron Lesseps to construct a sea-level canal, the miscarriage of which caused such widespread misery and ruin to many of the hapless shareholders some twenty years ago. But its failure in a sense cleared the way for the similar project now taken in hand by the Government of the United States of America, the prospects of which are, at least for the present, fairly hopeful and favourable. It is obvious to the reader that the author's personal predilections are in favour of a lock canal, and in this he has the support of many high authorities, of whom we need mention only one, viz. General Abbot, U.S.A., an engineer of distinction, who had exceptional opportunities of studying this problem when he was consulting engineer to the New Panama Canal Company. He placed on record his opinion that "it is the unanimous opinion of all the engineers who have had practical experience in canal work, and time to thoroughly study the problem, that no sea-level *projet* without locks, and no sea-level canal even with a tidal lock, is practicable that would be comparable in ease and safety of transit to one equipped with modern locks, and planned to take advantage of all the desirable elements which the natural conditions offer." Nevertheless, as is now well known, the United States Government has decided in favour of a sea-level canal, notwithstanding the fact that it will be more costly and take longer time to construct. The reader will find a fairly impartial statement of the arguments in favour of each kind of project in the pages of this work. The mere fact that the construction of the canal has been undertaken by the United States Government is a guarantee that sooner or later, and without consideration of expense, it will be carried through, unless owing to local seismic disturbances its completion and maintenance are proved to be a physical impossibility. One immediate result of the undertaking of the United States Government is that independence, peace, and the possibility if not the certainty of a prosperous future are secured to the republic of Panama which came into existence only in 1903. A glance at the map is sufficient to confirm the remark of the author that "the establishment of a waterway between the two great oceans of the globe will more

widely affect the commerce of the world than any single work or event in its history," but as Mr. Colquhoun in his *Key to the Pacific* observes, "it will benefit America in an infinitely greater degree than Europe." We gladly recommend this work to the perusal of our readers.

POLAR.

Handbook of Polar Discoveries. By A. W. GREELY, Major-General, United States Army. Third Edition. Revised and enlarged. Boston: Little, Brown and Company, 1907.

The volume now before us is a third edition of a work by General Greely, U.S.A., the first edition of which appeared in 1896, and met with general acceptance (see our review, *S.G.M.*, xiii. p. 50). During the twelve years which have elapsed since the publication of the first edition, there have been several important expeditions despatched by various nations to the Arctic and also to the Antarctic regions, and so a new and up-to-date revision of the original work was more than justified. It claims to contain in the compass of 300 pages the gist of 70,000 pages of original narrative, and this explains of itself how the reader will find in it merely a condensed statement of what has been done in the matter of polar discoveries up to the present day; if he wishes to have the details of how the various expeditions originated, progressed, succeeded or failed, he must turn to the original narratives of which he will find a very complete list compiled for his information in this book. Indeed, it seems to us that in the case of ninety-nine out of a hundred readers the principal use of this work will be as a book of reference, from which they can ascertain where to look for detailed information, and, regarded in this light, the *Handbook of Polar Discoveries* is distinctly valuable.

GENERAL.

Instrumentenkunde für Forschungs-Reisende. By Professor W. MILLER, with the assistance of Professor C. SEIDEL. With 134 figures. Hannover: Dr. Max Janecke, 1906. Price M. 4.40.

This pamphlet consists first of a general account of the instruments required by the scientific traveller; then of lists of those employed by certain actual expeditions; thirdly, of a detailed list of the chief forms of scientific instruments, with prices, weights, and specification, as made by various firms, chiefly German; fourthly, of a list of the addresses of the firms mentioned, with their telegraphic codes, and full information in regard to the cost of freight, etc., for the despatch of instruments to various parts of the world; and finally of an appendix on wireless telegraphy according to the "Telefunken" system. One is struck by the extraordinary industry which must have been required to get together all this mass of information. There can be no doubt that intending travellers, especially those of German nationality, will find much that is valuable in the brochure, but we are not clear as to its exact *raison d'être*, for it seems to present a curious combination of illustrated Maker's catalogue and scientific book. One wonders, for instance, why only Herr So-and-so's geological hammers should be mentioned.

Limnologia: Studio Scientifico dei Laghi. By DOTT. G. P. MAGRINI. Milan: Ulrico Hoepli, 1907. Price 3 lire.

This is one of the useful little Hoepli manuals, and serves to emphasise the increasing interest which is being taken in the study of lakes. The early chapters

discuss the methods and programme of a lake survey, giving some account of the instruments employed. They are followed by a discussion of the morphology of lakes, of the nature of the bottom, of the hydraulic *régime*, of the phenomena of seiches, of temperatures and their variations, of the colour, transparency, and biology of lakes. The appendices give some statistics in regard to Italian lakes, and also in regard to certain of the other lakes of Europe. The whole gives in small bulk a concise and valuable summary of the chief methods and results of Lake Survey and may be cordially recommended to those interested.

The East and West Indian Mirror; being an Account of Joris van Speilbergen's Voyage round the World, and the Australian Navigations of Jacob Le Maire. Translated, with Notes and an Introduction, by J. A. J. de Villiers. London: Printed for the Hakluyt Society, 1906.

The latest publication of the Hakluyt Society takes us back to a period of English history, the interest of which can never cease, at least for Englishmen. The sixteenth century was ended. During the last decade of the century the great captains, Drake, Hawkins, Frobisher, Cavendish, and others, one by one had left for ever the scenes of their glory; and Burleigh and Walsingham, the great ministers, and Philip of Spain, the arch-enemy of England, were all gathered to their fathers. In 1603 the great queen herself died, and in a couple of years was followed to the tomb by George Clifford, Earl of Cumberland, whose exploits by sea and land had placed him in the ranks of the greatest of the age. On the throne of England sat a pusillanimous pedant, who trembled at the sight of a sword or at the thought of war, and who, to his eternal infamy, threw into the Tower of London and shamefully sacrificed to the spite and rancour of Philip's son, Sir Walter Raleigh, an explorer and hero second to none of the illustrious band who in these stirring days were the saviours and makers of England. Lord Howard of Effingham, Lord High Admiral at the time of the Armada, was still alive, and must have watched with shame and disgust the unwelcome as unwonted spectacle of the policy of England being modified, if not moulded, according to the selfish diplomacy of a Spanish ambassador like Gondomar. The scene of rivalry and battle had been transferred from the English Channel, the ports and harbours of Spain and its colonies, and the routes of the Spanish treasure-ships, to the coasts of India and the Spice Islands, where the successors of Drake and the heroes of the Armada, Lancaster, the Middletons, Best, and others, gallantly and amidst most adverse circumstances, were laying the foundations of an imperishable empire, while they imagined they were only procuring cloves and pepper for the profit of the merchant adventurers of Founder's Hall. The once glorious sun of Spain was indeed setting for ever. The dawn of England's greatness should have been bright, but owing to the personal character of the English monarch it was dim and cloudy and doubtful; and an opportunity was given to a rival power to join in the *melée* for ascendancy on the sea and future empire, of which it was not slow to take advantage. Writing of the Dutch in 1609 Sir Thomas Overbury said: "There belongs to that State 20,000 vessels of all sorts. So that if the Spaniards were entirely beaten out of these parts, the kings of France and England would take as much pains to suppress as ever they did to raise them. For being our enemies, they are able to give us the law at sea; and ent us out of all trade, much more the French; having at this time three ships for our one, though none so good as our best." In the volume now before us we have narratives of Dutch naval skill and heroism, which enable us to appreciate and

understand how the Dutch were such formidable rivals to Spaniards, French, and British in the early days of the seventeenth century.

Very little is known as yet of the personal history of Joris van Speilbergen, the second Dutchman to circumnavigate the world; even the date and place of his birth are uncertain; he died in 1620 at Bergen op Zoom. He has left two journals of his voyages, the second of which is the one now published by the Hakluyt Society under the able editorship of Mr. de Villiers of the British Museum. The first journal contains a record of Speilbergen's voyage in 1601-3 to the Cape of Good Hope, Ceylon, Sumatra, Acheen, and Bantam. In 1607 Speilbergen took part under the famous Dutch Admiral Van Heemskercke in the victory over the Spanish fleet in the Bay of Gibraltar; and as Mr. de Villiers shrewdly suggests, it is very likely that the gallantry displayed on that occasion had much to do with his appointment to the command of an expedition in 1614. The expedition consisted of six ships (two of them very small), which sailed from Texel in August 1614, and, having circumnavigated the world, returned in July 1617. With characteristic modesty Speilbergen in his dedication to the States-General of the Netherlands says nothing about the dangers he had passed through, or the enemies he had sought out and defeated; he merely presents to them "the narrative of my last journey, performed with six vessels through the Magelanes, along the coasts of Chili, Peru, Nova Hispania, and California, the Maniles, Molucques, and other East Indian shores," where owing to limitations of space we may not follow him, but we can heartily recommend his journal to our readers as exceedingly interesting. It is also illustrated with a number of quaint maps and diagrams.

The second part of the volume contains the record of a voyage made by one Jacob Le Maire under circumstances much more appropriate to the pages of a romance than to those of a sailor's log. The good ship *Gendracht*, of 220 tons, armed and provisioned for a long voyage, left Texel on June 14, 1615, with sixty-five men on board, and of these only two, viz. Jacob Le Maire and William Cornelisz Schouten, knew where she was going. It appears that their High Mightinesses the States-General of the United Netherlands had forbidden every Netherlander, except the General East India Company, to sail east of the Cape of Good Hope or through the Straits of Magellan to India or anywhere else. But this was not at all to the mind of Isaac Le Maire, a renowned merchant of Amsterdam, and William Cornelisz Schouten of Hoorn, the latter being something of an expert, having already been thrice to the East Indies as skipper, pilot, and merchant. These two worthies "did often speak and deliberate together whether it were not possible to come by some other way not mentioned nor forbidden in the aforesaid charter (to the East India Company) unto the great South Sea, where they were of opinion they would discover great and rich countries in which ships would obtain rich cargoes." The result of these deliberations was an agreement "to go and make a search in the most southerly and unknown part of the earth, to look for a thoroughfare south of the Strait Magellaine extending to the aforesaid South Sea, of which they thought there was no small probability, from various particulars concerning the aforesaid Strait of Magelanes discovered by others at various times." On this Isaac Le Maire and William Cornelisz Schouten and a select body of friends elected themselves directors of the adventure, and induced the Netherlands public to subscribe the necessary funds "without however giving any of the participants any revelation or knowledge of the projected voyage, but keeping that secret among themselves, the aforesaid directors." The secrecy that was accepted by the subscribers was equally accepted by the sailors and petty officers, and it was not till the *Gendracht* crossed the Equator in the end of

October 1615 that the crews were informed of where they were going. On the 28th October it was announced that the aim of the voyage was "to get by a way other than the Strait of Magellanes into the South Sea in order to discover there certain new countries in the south where it was thought great wealth could be got, or, if that did not succeed according to desire, that we should then sail along the great South Sea to the East Indies. There was great joy among the crew that day concerning this declaration, for they now knew whither they were being taken, and each one hoped to get something on his own account out of a prosperous voyage and to profit by it." The *Gendracht* encountered the usual storms and hindrances on its way to Magellan Straits. On arriving there it sailed farther south, and on January 24, 1616, turned west through what appeared to be a new strait, which was promptly named "Fretum le Maire," having on the west side an island named after Prince Maurice of Nassau, and on the east some land which was called Staaten-landt. The ship's log goes on to say: "In the evening the wind veered to the south-west, and we then ran southward that night with a heavy roll from the south-west and very blue water, from which we opined and were certain that we had open and deep water on the weather side, not doubting that it was the great South Sea, whereat we were very glad, holding that a way had been discovered by us which had until then been unknown to man, as we afterwards found to be the truth." The aim of the voyage had thus been accomplished; but where were the rich countries with which to trade? The *Gendracht* held on its course, north and west, finding only petty islands, until, after much trouble from sickness and scurvy, and many hardships from hunger and hostile natives, they reached the coast of New Guinea. In September 1616 they cast anchor at Ternate, where they found one of the ships of Speilbergen's squadron. Soon after their arrival at Batavia, Jan Pietersz Koenen, the able and energetic but unscrupulous and tyrannical President of the Dutch East India Company, disbelieving, or pretending to disbelieve, the story of the discovery of a new passage south of Magellan Straits, confiscated the ship and the cargo as one not associated with the General Company, and as having set out on her voyage without their orders. The luckless Jacob Le Maire was transferred to Speilbergen's ship to be taken home to Holland, but on 22nd December he died at sea, "wherefore our Admiral and all the others were deeply grieved, since he was a man endowed with remarkable knowledge and experience in matters of navigation." Jan Cornelisz Schouten had died on board the *Gendracht* some four months previously. The other brother, Willem, returned with Speilbergen to Holland, but it was not till after two years' litigation that the injustice at Batavia was redressed.

The arduous task of translating and editing these quaint and interesting records has been skilfully and judiciously accomplished by Mr. de Villiers, who has also contributed a thoughtful and erudite introduction, in which much light is thrown on the *quaestio veritatis* of their authorship. The latest publication of the Hakluyt Society fully maintains the high standard of historical and literary merit for which the Society's publications have so enviable a reputation.

The Statesman's Year-book, 1907. Forty-fourth annual publication. Edited by J. SCOTT KELFIE, LL.D., with the assistance of J. P. A. RENWICK, M.A., LL.B. London: Macmillan and Co., 1907. Price 10s. 6d. net.

We have to extend our annual welcome to this invaluable volume which has been brought up to date, and is as usual illustrated by new maps and diagrams showing the important boundary changes during the past year, as well as other facts of current interest. The value of the annual hardly needs re-emphasis.

BOOKS RECEIVED.

Neardest the Pole: A Narrative of the Polar Expedition of the Peary Arctic Club in the ss. "Roosevelt," 1905-1906. By R. E. PEARY, U.S.N. Imperial 8vo. Pp. xx + 411. Price 21s. net. London: Hutchinson and Co., 1907.

Les Falaises de la Manche. Par JULES GIRARD. 4to. Pp. 194. Paris: E. Leroux, 1907. Presented by the Author.

Through Jamaica with a Kodak. By ALFRED LEADER. With introductory notes by HIS GRACE THE ARCHBISHOP OF THE WEST INDIES and Sir ALFRED F. JONES, K.C.M.G. Demy 8vo. Pp. xxii + 208. Price 6s. net. Bristol: John Wright and Co., 1907.

The Truth about the Congo. By Professor FREDERICK STARR. Crown 8vo. Pp. viii + 129. Chicago, U.S.A.: Forbes and Co., 1907.

A Scientific Geography. Book V., Africa. By ELLIS W. HEATON, B.Sc., F.G.S. Crown 8vo. Pp. 109. Price 1s. 3d. net. London: Ralph Holland and Co., 1907.

Sferc Cosmografiche e lora applicazione alla risoluzione di problemi di Geografia Matematica. Por Prof. DOTT. ANGELO L. ANDREINI (Manuali Hoepli). Crown 8vo. Pp. xxix + 326. Price Lire 3. Milana: Ulrico Hoepli, 1907.

Switzerland and the Adjacent Portions of Italy, Savoy, and Tyrol. Handbook for Travellers. By KARL BAEDERER. 22nd edition. Price 8 Marks. Leipzig, 1907.

A Book of the Cevennes. By S. BARING GOULD, B.A. Crown 8vo. Pp. xii + 308. Price 6s. London: John Long, 1907.

Tin Deposits of the World, with a chapter on Tin Smelting. By SYDNEY FAWNS, F.G.S. Demy 8vo. Pp. xii + 304. Price 15s. net. London: The Mining Journal, 1907.

The Royal Tour in India: A record of the Tour of T. R. H. The Prince and Princess of Wales in India and Burma, from November 1905 to March 1906. By STANLEY REED. With a preface by Sir WALTER LAWRENCE, Bart. G.C.I.E. 4to. Pp. xxiv + 514. Bombay: The Times Press, 1906.

Geographical Distribution of Vegetation in Somerset: Bath and Bridgwater District. By C. E. MOSS, M.Sc. Pp. 71. London: Royal Geographical Society, 1907.

The Central Alps. By the late JOHN BALL, F.R.S., etc. Part I. A new edition reconstructed and revised on behalf of the Alpine Club under the general editorship of A. V. VALENTINE-RICHARDS. Crown 8vo. Pp. xxviii + 326. Price 6s. 6d. net. London: Longmans, Green, and Co., 1907.

Isle of Man Illustrated. Written by Rev. JOHN QUINE. Pp. 100. Price 1s. Bournemouth: Mate and Son, 1907.

Also the following Reports, etc. :—

Guide to the Great Game Animals (Ungulata) in the Department of Zoology, British Museum (Natural History). London, 1907.

Extracts from Narrative Reports of Officers of the Survey of India for the season 1904-1905. Prepared under the direction of Colonel F. B. LONGE, R.E. Calcutta, 1907.

Central Provinces District Gazetteers: Sambalpur District. Edited by R. V. RUSSELL, I.C.S. Allahabad, 1907.

Bengal District Gazetteer: Darjeeling. By L. S. S. O'MALLEY. Calcutta, 1907.
Administration Report on the Railways in India for the year 1906. Simla, 1907.

Twenty-Fourth Annual Report of the Bureau of American Ethnology, 1902-1903. By W. H. HOLMES. Washington, 1907.

Sociological Papers. Vol. III., 1906. London: Macmillan and Co., 1907.

THE SCOTTISH GEOGRAPHICAL MAGAZINE.

GEOGRAPHY AND COMMERCE.¹

By GEORGE G. CHISHOLM, M.A., B.Sc.

THE subject which I have chosen for this address is one that is very apt to raise questions that might lead to keen and even warm controversy. For the raising of such questions no occasion could be less suitable, and it will therefore be my endeavour to handle the subject in such a manner that burning questions may be altogether avoided. For that reason I propose to consider the relations of geography and commerce from an historical point of view, which at least gives one the opportunity of confining oneself to less debatable ground than is entered on when one ventures on prophecy, that "most gratuitous form of error," as it is styled by George Eliot. That I shall be able to keep wholly free from debatable matter is more than I can hope, but it is my intention to try to avoid it as much as possible by illustrating my subject chiefly by reference to the broad, familiar facts of commerce considered in the light of geographical and other implications that may be described as obvious—obvious, and yet perhaps not unimportant and not unworthy of having attention specially called to them; for, after all, the obvious is obvious only to those who are looking in the right direction and with the proper focus, not to those who are looking another way or far beyond what is immediately before them.

As the first of these obvious considerations I may point out that unquestionably the foundation of commerce is the mutual advantage to be derived from the exchange of commodities produced in different places. Geographical relations are therefore of necessity implied in commerce. But those who carry on commerce have always aimed at the greatest possible advantage to themselves, and the commerce that

¹ Presidential Address to Section E (Geography), delivered at the Leicester Meeting of the British Association.

has always attracted the greatest attention is that which has resulted in the greatest additions to their wealth. Peculiar importance therefore belongs to the geographical relations between regions which under any given circumstances lead to the most profitable exchanges.

But before applying this consideration there is another point which must detain us a little. In speaking of wealth as I have just done I am aware that I have made use of a term which economists recognise as one requiring a great deal of exposition to prevent misunderstanding, and there is not the slightest doubt that in the history of commerce it has led to great misunderstanding, and therefore it is necessary, without entering upon an economic disquisition on the subject, to consider the meaning of the term "wealth" sufficiently to indicate the way in which that misunderstanding has arisen. For this purpose it will be most convenient not to give one of the highly abstract definitions of wealth which a modern political economist will give us, but to go back to the more concrete considerations set forth by Adam Smith, who tells us that "the wealth of a country consists not in its gold and silver only, but in its lands, houses, and consumable goods of all different kinds."¹ Now no definition of wealth is given by economists which excludes this last form of wealth, but the misunderstanding to which I refer arises from the fact that this form of wealth is apt to be overlooked. It may happen that a country or region produces a great abundance of consumable goods in proportion to its population, and hence from this point of view be entitled to be regarded as wealthy, and yet may not be a country or region that attracts much attention by its wealth. What has always attracted attention to wealth, and what has caused wealth to have an important effect in directing the main streams of commerce, and commerce to have an important effect, direct or indirect, on history, has been the accumulation of much wealth in few hands, so that a comparatively small number of people in a community have enjoyed, directly or indirectly, the command of a great deal of labour, have had the means of providing themselves with commodious and luxurious houses, with a variety of other comforts, luxuries, and splendours, and over and above that the means of so directing labour as to add still further to their wealth. Such conditions may exist where the great bulk of the population are extremely poor.

Now, it happens that wherever a great abundance of consumable commodities is produced on a relatively small area there is always in that area a greater or smaller number of individuals in whose hands much wealth is concentrated. It is for economists to explain how this comes about, or has come about, but it is a fact of the utmost importance for geographers to bear in mind in considering the relations of commerce and geography.

The existence of a relatively dense population may be due to different causes, such as a great abundance of agricultural products, the carrying on of mining or manufacturing industries, the concentration of the administration of a great dominion, or the pursuit of commerce

¹ *Wealth of Nations*, book iv. ch. i.

itself. Where it is due to any cause but the production of great quantities of the necessities of life, foodstuffs must be imported in large quantities, and where the pursuit of manufactures is the cause, or one of the chief causes, then the importing of raw materials is entailed. Where these are most advantageously found there also much wealth is likely to be accumulated in few hands.

Further, it is to be noted that where a comparatively small number have the command of much wealth there is sure to be a demand for things of such value that they can be bought only by the wealthy, things that are more or less rare, such as precious metals, jewels, gems, ivory, fine woods, ornamental skins and feathers, manufactured goods of rare materials or of fine quality, as well as, in many places and in most periods of history, slaves. Such trade is necessarily limited in amount, but puts great profits in the hands of those who carry it on with success, and for that reason attracts attention.

With this class of goods may be associated certain others that may be regarded as intermediate in position between those which are bought only by the wealthy and those which are not merely generally consumed but also very widely produced. Amongst these may be mentioned salt, the consumption of which is universal, but the production of which, away from the seaboard of the warmer latitudes, though in a sense widespread, is strictly confined to scattered spots. A more interesting example is that of spices, one of which, pepper, has from a remote period been very generally consumed, but in still smaller quantity than salt, and for that reason has been able to bear still higher transport costs. For ages these costs were very high, for various reasons, amongst which were risks both numerous and great, but the profits of those who were successful in the trade were proportionately high.

Peculiar importance in commercial geography is thereby given to the relations between the regions that yield or yielded spices and those in which they were consumed at a great distance from the place of origin, and one of the most important facts in human history is that for many hundreds of years an extremely valuable trade in these commodities was carried on between India and the Mediterranean. Spices no doubt were less talked about, less prominent as symbols of wealth, than gems and jewels, fine woods and ivory, but they formed the basis of a larger trade, which was in the aggregate probably more profitable than that in the still more costly wares.

The geographical relations between India and the Mediterranean necessarily determined the routes followed by this traffic. These routes were singularly few. They were practically confined for the most part to minor variations in two main routes, one by way of the Red Sea, the other by the Persian Gulf. At more than one period of history, in very early times in the days of the splendour of Assyria and Babylonia, and again in the flourishing days of the Caliphs of Baghdad, the Persian Gulf route had a peculiar advantage in the existence of the large and rich populations that afforded an intermediate market; and another important fact in the relations of geography and commerce, one that has had vast effects on human history, is that the physical conditions of the

area between the head of the Persian Gulf and the Mediterranean are, and throughout human history have been, such as to make the most convenient outlet of that route some point or points on that seaboard which in ancient times was known as Phœnicia. Between that seaboard and the Euphrates the desert is sufficiently narrowed to be most easily crossed. The most favoured outlets on this seaboard were not always the same. They varied in different circumstances which gave a different geographical value now to one point, now to another. But on these variations, interesting and instructive as they are from a geographical point of view, there is no time to enter on this occasion, and it will be enough to call attention to a very interesting paper by the late Elisée Reclus, entitled "*La Phénicie et les Phéniciens*," dealing with this and other matters connected with the geographical basis of Phœnician commerce and industry—a paper too that is apt to be overlooked, inasmuch as it was contributed by him with a generosity characteristic of one of the least self-seeking natures with which the world was ever blessed to a rather out-of-the-way publication, the *Bull. de la Soc. Neuchâteloise de Géog.* (vol. xii. 1900). But while I do not desire to enter into details regarding the Phœnicians it is necessary to point out how naturally and indeed inevitably this position of the Phœnician cities between the Mediterranean on the one hand and Mesopotamia and the Persian Gulf route to India on the other hand brought other sources of wealth in its train. Conveniences for the distribution of manufactured goods have always been one of the most important advantages for the development of manufacturing industry, and the wealthier the community forming the market for the products of such industry the more valuable are the manufactures likely to be. Hence the Phœnician manufactures of fine linens and woollens richly dyed, glass and metal wares, for which other parts of the Mediterranean and its seaboard furnished the raw materials, slaves to do the manual labour, and food for that population which the narrow strip of Phœnicia could not adequately supply. Food is indeed a bulky commodity, but even bulky commodities could be transported by sea at a relatively small cost, and in connection with this traffic we must note the indirect effect which the wealth of Phœnicia must have had in promoting the settlement of districts favourably situated for supplying food, and especially of such districts where the opportunities for producing food were great, but not fully turned to account, where the supply therefore could easily be made superabundant in proportion to the wants of the population. This shows that from the very nature of commerce its benefits are not confined to one side. Although the geographical conditions for a long period of time led to a special accumulation of the wealth due to commerce in Phœnicia, Phœnician trade promoted the growth of wealth and civilisation elsewhere. The Greeks of the *Ægean* distinctly recognised what they owed to the Phœnicians, and they in their turn derived much wealth from Eastern trade, even though not so directly as the Phœnicians, and they in their turn derived some of the food for a commercial population from the far west—from Syracuse, Sybaris, and even the distant Kume. But the far east had a peculiar

fascination. As the articles from which much of the wealth of commerce was derived originally came from India, it was natural that the idea should arise that India was a wealthy country, a country well worth possessing. I am not aware whether India ever was in historical times a wealthy country in the sense of producing a great abundance of the necessaries and ordinary conveniences and comforts of life in proportion to the population, but if it was not rich itself it was at least the means of making others rich. There can hardly be a doubt that the desire of possessing this country of real or imagined wealth was prominent among the motives that led Alexander the Great to embark on that enterprise which had such surprisingly—one might almost say miraculously—widespread, profound, and lasting effects on the history of the Near East. If we may accept as historical the speech in which Quintus Curtius represents Alexander as having addressed his troops after his victory over Porus, in order to encourage them to advance further into India, that speech affords fairly strong evidence of what has just been stated. "What now remained for them," said Alexander, "was a noble spoil. The much-rumoured riches of the East abounded in those very regions to which their steps were now bent. The spoils accordingly which they had taken from the Persians had now become cheap and common. They were going to fill with pearls, precious stones, gold, and ivory not only their private abodes, but all Macedonia and Greece."¹ Alexander was no merchant. Pepper was beneath his notice. His symbols of wealth are those which have always most powerfully affected the imagination. Later on, however, we shall meet with a king who was a merchant, and who understood perhaps better than Alexander wherein consisted the value of Indian trade.

At the outset of his career Alexander had destroyed Tyre, thinking, no doubt, that he had thereby wiped away the claims of one rival for a share of the wealth of the East; but it is a noteworthy fact that he did not thereby destroy the value of the site of Tyre under the conditions which then subsisted. Tyre revived and again obtained wealth from its trade with the East, as it did again and again in subsequent history. A heavier blow to Tyre than its mere destruction was the ultimate accomplishment of Alexander's idea for founding a great seat of commerce on the harbour which he saw could be created in the neighbourhood of the Nile delta. The foundation of Alexandria and the successful efforts of the successors of Alexander in Egypt to divert a large part of the trade in spices and other Oriental goods to the Red Sea route for the Mediterranean did more than a single act of war to deprive Tyre and other Phœnician cities of the peculiar pre-eminence which they had long enjoyed in the trade of those wealth-bringing commodities.

But perhaps the history of Venice shows even more clearly than that of Tyre the importance of this eastern trade in connection with certain inevitable geographical relations. The foundation of the future commercial glory of Venice may be said to have been laid when Rome

¹ J. W. M'Crimble, *The Invasion of India by Alexander the Great* (1893), p. 215.

planted her colonies north of the Po. The gradual clearing of forests gained for agriculture to a greater and greater extent one of the most favoured agricultural areas in Europe. There resulted a superfluity of agricultural products which begot a trade by sea. The great outlet of this plain in Roman times was Aquileia, which in the beginning of the fifth century, when no one of discernment could imagine that there would ever be other than Roman times, was described by a Roman man of affairs and minor poet as one of the nine great cities of the world. But before that century was out Aquileia was destroyed, never to recover. The value of its site was replaced, and that in a strange way, which no man of discernment could ever have foreseen. The time that saw the destruction of Aquileia and the times that immediately followed were such as made safety a prime consideration, especially for all who possessed or desired to possess wealth. Refugees from Aquileia, and afterwards from other Italian cities, thought at first of nothing but safety. Many of them found it on a few muddy and sandy islands near the muddy shores of the lagoon in which Venice now lies. But here they found the means of trade. The sea could be made to furnish both fish and salt, and the rivers that flowed into the lagoon enabled them to exchange these commodities for provisions of other kinds which the adjoining land could supply. Gradually this commerce grew, until in the eighth century we find the Venetians trading with Syria and Africa, Constantinople, and the ports of the Black Sea.

Throughout the period of growth the policy of this trading republic, both by land and sea, is very significant. Venice early realised the force of Bacon's maxim "that he that commands the sea is at great liberty, and may take as much and as little of war as he will." Power at sea was necessary to provide security for her commerce. In early times she generally owed allegiance to the Eastern Roman Empire, a suzerainty which could do her little harm and could and did do her much good. To that allegiance she adhered until she was strong enough to turn against and reap advantage from the overthrow of her suzerain. At an earlier date, before the close of the tenth century, she had conquered Dalmatia, and thereby destroyed the hordes of pirates who had found refuge in the innumerable harbours of that coast and constantly harassed the commerce of the Adriatic. At every opportunity she secured establishments and acquired possessions in the Levant.

On the land side, however, dominion would have added more to her risks than her advantages, and that dominion was not sought. For more than eight hundred years after the first flight to the islands of the lagoon, more than six hundred after the election of the first Doge (697), Venice possessed no territory on the mainland beyond a mere narrow ribbon on the edge of the lagoon. The nature of the situation made her indispensable to the trade of the land immediately behind. An incident belonging to the close of the ninth century illustrates the force of this observation. A keen dispute had arisen between the Patriarch of Aquileia and the Patriarch of Grado. Venice supported the Patriarch of Grado and war seemed to be threatened. But so necessary had the commerce of Venice become to the inhabitants of the territory acknow-

ledging the authority of Aquileia that in order to bring about the submission of the Patriarch of Aquileia it was enough to close or blockade the port of Pilo, on the mainland opposite the *lidi*. The subjects of Aquileia then forced the patriarch to sue for peace.¹ On another occasion, in a dispute with the Bishops of Belluno and Treviso, the matter was again partly settled through the efficacy of the measures taken by the Doge Orseolo II., with the consent of the people, to stop commerce with the territory of the bishops, by which the inhabitants found themselves without supplies of salt, and without the means of exchanging their leather and meat for Venetian wares or selling the abundant timber of their forests for the building of Venetian ships.² In holding the outlets for maritime commerce, Venice felt herself to be in the possession of "the keys of trade," to use the expression employed by Sir William Petty in speaking of the analogous position of Holland in later times at the mouths of the Rhine, Meuse, and Scheldt.

But while possession on the mainland was not necessary to Venice she always recognised and sought the advantage of good relations with the occupants of the plains behind her, whoever these occupants might be, and on every occasion endeavoured to turn to her own benefit the vicissitudes of those plains. In her earlier days she is found now in alliance with the Greeks, now with the Pope, now with the archbishops of Ravenna, and now with the Lombards, just as it happened to suit her interests, and in any case taking every opportunity of obtaining direct and indirect advantages from trade with the most profitable customers in the plains. When famine pursued the steps of the Lombard invaders of Italy in the sixth century, "the Venetians in their pacific retreat," says Mutinelli,³ "could send their ships to the ports of Apulia and elsewhere to obtain victuals and corn for the famished barbarians," and in consequence the Lombards took them under their protection and granted them security and favours throughout the Lombard kingdom. When Charlemagne, at the invitation of the Pope, invaded Italy to deliver the Church from its subjection to the Lombards, Venetian traders promptly appeared in the camp of the Franks at Pavia and sold to the Frankish chiefs all the riches of the East—Tyrian purples, the plumage of gay birds, silks, and other ornaments, pranked in which the purchasers stalked about in their pride, feeling, no doubt, that now at last they had conquered a land whose wealth would reward all their labours and hardships.⁴ Charlemagne, it is true, was inclined to look with little favour on the Venetians, whom he regarded as supporters of the Greeks, but an attack by his son Pepin in 809 on the islands of the lagoon only served to establish the strength and security of their position, at least on the inner islands of the lagoon. By closing the passages of the canals, removing the navigation beacons, and fortifying and barring the chief entrances to the land they succeeded in holding out during a siege of six months, till the heats of summer began to decimate the troops of Pepin,

¹ Romanin, *Storia documentata di Venezia*, vol. i. pp. 197-8.

² *Ibid.*, pp. 270-1.

³ *Del Commercio dei Veneziani*, p. 12.

⁴ *De rebus bellicis Caroli Magni*, L. iii., quoted by Romanin, as above, vol. i. p. 130.

who, on hearing also of the approach of a Greek fleet, came to terms with the Venetians on conditions similar to those which had been maintained with the Lombards. The Venetians agreed to a tribute, but solely for the narrow strip of territory held on the mainland and in return for commercial privileges in the Frankish dominion, not for any recognition of the existence of the State. The tribute was afterwards paid or withheld according to the power which the emperors showed of enforcing it; but one permanent result of this incident was that the Venetians, perceiving the smaller security belonging to the islands nearer the mainland, of their own choice made the Rialto the capital of their little State.¹ (810).

As a last illustration of the nature of the relations of Venice to the North Italian plains, we may refer to some of the points mentioned in a celebrated and often quoted address delivered to the principal senators of Venice by the Doge Mocenigo just before his death (1423), at the time at which Venetian trade was at the very height of its prosperity. At that time Venice was in possession of a considerable tract of adjacent territory on the mainland, and there was a party favourable to further action on the part of Venice against the growing power of Milan. The aged and sagacious Doge feared that this party was going to gain the upper hand and elect as his successor Francesco Foscari, who, he thought, would involve them in dangerous and disastrous as well as useless enterprises. The immediate occasion of the conflict of views in the Venetian Senate was a request of the Florentines for support against alleged designs of the Duke of Milan. Mocenigo, however, not only warned the senators in the most earnest and urgent language against Foscari personally, but also advised them against the particular enterprise, maintaining that it was of no consequence even if the Duke of Milan made himself master of Florence, since the artisans of Milan would continue to send their manufactures to Venice, and the Venetians would be enriched to the loss of the Florentines. He then went on to give particulars of the trade of Venice at that time, dwelling specially on the value of that with Lombardy. To Lombardy alone, it appears, Venice sold every year cloths to the value of 400,000 ducats, *tele* (? linens) to the value of 10,000 ducats : wools of France and Spain to the value of 240,000 ducats, cotton to the value of 250,000 ducats, wine to the value of 30,000 ducats, cloth of gold and silk to the value of 250,000 ducats, soap to the same value, spices and sugar to the value of 539,000 ducats, dye-woods to the value of 120,000 ducats, other articles 110,000 ducats : in all, goods to the value of more than 2,500,000 ducats, the profit amounting to quite half a million ducats. With the exaggeration that comes natural to a lover of his country, Mocenigo goes on to say rather grandiloquently that to the Venetians alone land and sea were equally open ; to them only belonged the carriage of all riches ; they were the providers of the entire world.

All this trade, as well as that of Genoa and other Italian ports which shared with others in the spice trade, must have had a remarkably fructi-

¹ Romanin, as above, vol. i. pp. 144-9.

fying effect in North Italy generally. Agriculture and manufactures would be alike promoted, and in consequence of that the growth of population; and when war, with its attendant scourges, led to a diminution both of industry and population, this commerce could not fail to assist in bringing about a speedy recovery. It has already been hinted that in manufactures both Milan and Florence took a prominent place in the time of Mocenigo. In truth, manufactures in both cities are of much older date, and it may be interesting to mention here that even in the thirteenth century English wool was a commodity sufficiently valuable to bear the cost of transport to Florence. A letter has come down to us,¹ dated London, January 6, 1284, from the representative of a Florentine house, giving particulars as to purchases that he had made, in many cases for several years in advance, of all or a portion of the wool of many English monasteries from Netley and Titchfield, in Hants, and Robertsbridge in Sussex, to Grimsby, in Lincolnshire, and Sawley, on the Ribble, in the county of York (one of these monasteries, you may be interested to learn, as near Leicester as Monks Kirby, about midway between Rugby and Nuneaton), and from the work in which this letter is published we also get particulars² as to the cost of conveying wool from London by way of Liborne to the Mediterranean port of Aigues Mortes in the same or the following century. Florence, indeed, depended on England, Spain, and Portugal for wools of fine quality, its own and other wools of Italy being of very inferior value, so that when four bales of English wool were worth in Florence 240 gold florins, the same quantity of wool of Garfagna dell' Aquila was worth only forty florins.³ The author of this work adds that he has found no indication of the prices of the wools of Spain and Portugal in Florence. Besides manufacturing cloths from the raw material, "Florence carried on a large trade in dressing and finishing woollens manufactured in Flanders and Brabant, and brought to Florence either by way of Paris and the Saône-Rhône valley or by way of Germany and across the Alps. In the time of Mocenigo many of these products of Florentine industry came to Venice for export. In the address already referred to, Florence is said to have sent to Venice every year 16,000 pieces of cloth, which were sold to Aquila, Sicily, Syria, Candia, the Morea, and Istria.

It will be noticed that in the address above quoted Mocenigo lays no special stress on the spice trade, but there is not the slightest doubt that spices were amongst the most important commodities with which

¹ Published (1765) in a work having no author's name, but stated in the British Museum Catalogue to be by G. F. Pagnini della Ventura, and bearing the title *Della Decima e delle altre Gravasse della Moneta, e della Mercatura de' Fiorentini fino al secolo XVI.*, the third volume of which contains *La Pratica della Mercatura* of Balducci Pegolotti (ascribed to the first half of the fourteenth century), under whose name the work is entered in the British Museum Catalogue. The date of the letter is given on p. 94 of vol. ii., and the letter itself on pp. 324-7 of the same volume. For the identification of the names of monasteries in their much-disguised Italian forms and spelling, I am indebted to my friend, Mr. A. B. Hinds, M.A., editor of the last-issued volume of the *Calendar of State Papers (Venice)*. Most of them, however, are entered and identified in the list given from Pegolotti on pp. 629-41 of Cunningham's *Growth of English Industry and Commerce, Early and Middle Ages*, 4th edition (1905).

² *Ibid.*, vol. iii. pp. 261-3.

³ *Ibid.*, vol. ii. p. 95.

the Venetians provided a large part of the western world. Just as nowadays the large trade of Britain in bulky goods makes of this country a great *entrepôt* for the more valuable and less bulky, so in Venetian times the exceptionally large population behind Venice receiving and supplying the bulky goods thus fed the shipping which brought to Venice a much larger proportion of the more valuable goods of the East than was brought to other ports. But there is plenty of direct evidence of the importance of Indian trade to Italy in the Middle Ages. It is to be remembered that of necessity this trade enriched other countries before it reached Venice, and in proof of its importance in the Mediterranean generally one may call attention to the investigations of the Venetian Marin Sanuto Torcello about the end of the thirteenth century, who, we are told, saw with indignation that the defeats of the Christians in Palestine were specially due to the power of the Soldans of Egypt, and perceiving that their great power derived its nourishment from the commerce with the Indies, based on that observation the projects which he urged on Christendom for the overthrow of that power. It is further significant that a sea way to India should have been sought by Genoese as early as 1291,¹ and even more significant that, a century later, Venice should have found it worth while to maintain a consul in Siam.²

But the clearest evidence of the supreme importance of the Indian trade to the Italian cities is to be found in the results of the discovery which finally diverted from Venice and the Mediterranean the great bulk of the Indian trade until that trade had lost all the special significance which it had retained for thousands of years. It need hardly be said that I refer to the discovery of the sea way to India by the Portuguese in 1497-99. Of the feeling aroused in Venice by this discovery Romanin has reproduced,³ from the *Diarii* of Priuli, an interesting contemporary record, written with reference to a despatch to the Doge, probably from Pietro Pasqualigo, a Venetian envoy at Lisbon at the time of the return of the second Portuguese voyage to India under Cabral. The letter is stated to have reached Venice on July 24, 1501. After giving the letter, in which we are told, among other things, how the Portuguese had charged their ships at Cochin with spices at a price which the writer feared to mention, Priuli adds: "On the arrival of this news at Venice all the city was deeply moved and remained stupefied, and the wisest held it for the worst news that could reach them. For, it being recognised that Venice had risen to so high a degree of renown and wealth solely by the commerce of the sea and by navigation, by means of which every year a great quantity of spices was brought thither, which foreigners then flocked together to acquire, and that by their presence and the traffic they obtained immense advantages, now by this new voyage the spices would be brought from the Indies to Lisbon,

¹ See the account of this attempt, and its results, so far as they are known, in G. H. Pertz, *Der älteste Versuch zur Entdeckung des Seeweges nach Ostindien*, Berlin, 1859.

² Romanin, as above, vol. iii. p. 335, note (5).

³ As above, vol. iv. p. 461.

where Hungarians, Germans, Flemings, and French¹ would seek to acquire them, being able to get them there cheaply; and that because the spices that came to Venice passed through the whole of Syria and the countries of the Soldan, paying in every place exorbitant duties, so that at their arrival at Venice they were so weighted that, what at first was of the value of a single ducat, was raised in the end to sixty, and even a hundred ducats; from which vexations, the voyage by sea being exempt, it resulted that Portugal could give them at a much lower price." So said the wisest, but it is interesting also to note what was said by the less wise. Priuli goes on: "And while the wisest saw that, others refused to believe the story [these, I presume, were the least wise], and others again said that the King of Portugal would not be able to continue this navigation to Calicut, since of thirteen caravels only six had returned safe, the loss would be greater than the advantage, and that it would not be so easy to find men who would consent to risk their lives in so long and perilous a navigation; that the Sultan of Alexandria, seeing the loss of so fine a profit as that obtained by the passage of the spices through his lands, would see to that."

But in this case it happened that the wisest were right. The effects of this discovery were not long in making themselves felt in the notable diminution in the sales of spices at Venice. Under the date February 1504 Priuli enters in his diary, "The galleys of Alexandria have entered into harbour empty: a thing never before seen." In the following month the same thing happened in the case of the galleys from Beirut.² Under August 1506 it is stated that the Germans at the fair of the preceding month had bought very little. Various remedies for these evils were thought of, and among these it is interesting to note that in 1504 the Council of Ten seriously discussed a proposal to empower an envoy to the Sultan of Egypt to come to an agreement with him, if possible, for the cutting of a canal through the Isthmus of Suez.³ But the proposal was not adopted. Other efforts to avert the results of the great achievement of the Portuguese were vain. Other disasters befell the republic about the same time. Not only was commerce taking another direction, but, says Romanin, "the wars of Italy were emptying the treasury, the Turkish power was despoiling the republic step by step of its possessions beyond the sea, and Venice was beginning to descend that incline which was to reduce it to a subordinate position among the powers of Europe."⁴ North Italy generally suffered at the same time. The withdrawal of the greater part of the spice trade, by diminishing the growth of wealth among the inhabitants, made that part of the world a less important market for manufactured goods. Countries outside of Italy, where rival manufactures had already started, were increasing their wealth more rapidly, and thus imparting an increasing stimulus to their manufactures, and these increased while those of Italy

¹ We must recognise with due humility that the English are of little account in Venetian eyes in 1501.

² G. Coen, *Le Grandi Strade del Commercio Internazionale proposte fino dal Sec. XVI.* (Leighorn, 1888), p. 71.

³ Coen, as above, pp. 82-83.

⁴ As above, vol. iv. p. 466.

declined. In 1338 the number of woollen factories in Florence is given at 200, making in all 70,000 to 80,000 pieces of cloth in the year; in 1472 the number of shops or factories had risen to 270, but no estimate is given of the quantity of the product; in 1529, however, the number of shops is said to have sunk to 150, and the quantity of cloth manufactured to 23,000 pieces per annum, and in the time of the editor of Balducci Pegolotti the quantity was only about 3000 pieces annually.¹

Before going further, however, there is one point in the comments on the discovery of the sea way to India quoted above from the *Diarii* of Priuli which calls for notice. Hungarians, Germans, Flemings, and French, he observes, will in future go to Lisbon to get the spices of India more cheaply than at Venice. This remark illustrates the difficulty of shifting the geographical point of view according to circumstances, a difficulty of which at all times abundant illustrations can be offered. The purchasers of spices who come first into the mind of Priuli are Hungarians and Germans. It was inevitable that they should be among the leading customers of Venice. The Hungarians were supplied from the Dalmatian ports which belonged to Venice. The Germans came by way of the Rhine and the Elbe, and then across the Alps to get supplies for central, north-western, and northern Europe. But it was neither Hungarians nor Germans who came in greatest numbers to Lisbon to buy the spices which Portuguese ships brought from the East. In any case Lisbon had no advantages like those of Venice for supplying by land a large and rich population immediately behind it. The valley of the Tagus was small and poor, and had not the capacity for expansion in wealth and population which the Lombard plains had when the commerce of Venice began to grow. The bulk of the spices brought to Lisbon had therefore to reach their final markets by routes that did not pass through Lisbon into the interior. To supply the most important of those markets it was the Dutch, the people who held "the keys of trade" for the important valleys of the Rhine, Meuse, and Scheldt, who came to Lisbon in greatest numbers to buy spices of the Portuguese. And here it has to be added that, in spite of the discovery of the sea way to India, the Venetians continued to retain great advantages in the spice trade with Hungary and parts of Germany, as well as, of course, the northern plains of Italy. Things did not remain always as bad as recorded in the years 1504 and 1506. The Portuguese, while maintaining successfully for a hundred years the monopoly of the trade in spices at the place of origin in the East, found their advantage in dividing the trade with Europe between the sea way and the Persian Gulf route, of which latter route they held the key since the final capture of Ormuz in 1515. The trade by way of the Tigris through Baghdad (the so-called Babylon of those days) and the Euphrates to the old Phœnician seaboard was again revived, and was maintained as long as Portugal held command of the trade. It was by this route that the first English commercial expedition to India, that of Newberie, Leedes, Story, and Fitch, went out in 1583, and by which Ralph Fitch, the sole survivor of that expedition, returned in 1591.

¹ *Della Decima*, as above, vol. ii. pp. 64, 105.

By this route Venice got back some of her spice trade; not perhaps with the same profit to herself as formerly, but still a trade of no slight importance not only to Venice, but also to Augsburg, Nuremberg, and some of the other cities of South Germany.

But beyond doubt the bulk of the trade was now carried on by the sea route, and we are thereby enabled to get a better idea both of the amount and the nature of the trade. On both points we get information from the *Narrative* of the above-named Ralph Fitch, who tells us that "the Fleete which commeth every yeere from Portugal, which be foure, five, or sixe great shippes, commeth first hither [to Goa.] And they come for the most part in September, and remaine there fortie or fiftie dayes; and then go to Cochín, where they lade their Pepper for Portugal."¹ Now in 1583 a ship of 500 tons would certainly be called a great ship. In 1572 the largest vessel sailing from the port of London was of 240 tons,² and the largest of the first fleet of the East India Company was one of 600 tons. I could give more definite information as to the capacity of these fleets at that time if I knew exactly what a *salma* was, for in a report on Portuguese trade sent to the Grand Duke Ferdinand I. of Tuscany (1587-1608) we are told that the fleet consisted of four or five carracks of the capacity of 5000 or 6000 *salme*.³ But a *salma* is a term for which one sometimes gets a very indefinite meaning, at other times definite but very diverse meanings, sometimes a weight of 25 lbs., which is obviously too little, and again a weight of 1000 lbs., which is probably too much. The large dictionary of Tommaseo gives this latter weight with an example stating the capacity of a ship; but if that were the meaning then the carracks would be of a burden of from 2250 to 2700 tons, a much heavier tonnage than is elsewhere indicated, so far as I am aware, for vessels of the period. Probably 3000 tons would be the outside limit of the aggregate cargoes annually brought to Portugal, for in any case much room in the ships was required for the large crews of those days with their armaments, for then the idea of carrying on commerce by sea without being in a position to defend your ship was out of the question.

Of the commodities sent home from India, Fitch mentions in this place only pepper, and the correspondence of Albuquerque with the King of Portugal soon after the discovery of the sea way to India clearly reveals how all-important the pepper trade was; but it may be worth while to give the complete list of the commodities which Ralph Fitch enumerates at the end of his *Narrative* as coming from India and the country further eastward. The list is not a long one. It comprises pepper, ginger, cloves, nutmegs and maces, camphora ("a precious thing among the Indians . . . solde dearer then golde"), lignum aloes, long pepper, muske, amber, rubies, sapphires, and spinels, diamants, pearles, spodium, and many other kindes of drugs from Cambaia—all of them, it will be observed, having the character of being of high value in proportion to their bulk, so that

¹ Horton Ryley, *Ralph Fitch*, p. 61.

² *Ibid.*, p. 17.

³ Angelo de Gubernatis, *Memoria intorno ai viaggiatori Italiani nelle Indie Orientali dal secolo XIII. a tutto il XVI.*, p. 149.

a very great value of such goods might be carried in ships of small capacity.

Fitch does not tell us what was sent in return, but information as to that is to be had from other sources and presents one or two points of interest. In 1513 Albuquerque, after a long course of fighting, concluded a peace with the Zamorin of Calicut, in which it was agreed, among other things, that the Zamorin should supply the Portuguese with all the "spices and drugs" his land produced, and that "coral, silk stuffs, quick-silver, vermilion, copper, lead, saffron, alum, and all other merchandise from Portugal" should be sold at Calicut as heretofore.¹ Coral comes first in this enumeration. To us at the present day this does not seem a very important article of commerce, but it was otherwise then. One Mafio di Priuli, writing from India in 1537 to the Magnifico M. Constantino di Priuli, says, "At a great fair which is called that of Tremel I have seen buttons of coral sold for their weight in silver."² That is the point of view of a European in India, but a native of the East Indies in Europe at the same date would no doubt have spoken with astonishment of the amount of silver that could be got in Europe for a few grains of pepper. Our letter-writer says in his cheerful, hopeful, gossiping way, "The gains of these parts are other than those of Damascus, Aleppo, and Alexandria: for if one does not gain cent. per cent. from Portugal here, and from here back again, one thinks that one gains nothing. And three or four years would be quite enough."³ But, while he indicates how these immense gains are made, he also indicates clearly enough how they continue to be made—that is, how they are so counterbalanced by losses that if these great gains were not made on occasion commerce would cease. It was all very well to exchange your coral for spices, but the great matter was to get your coral out and your spices home in safety. The writer of this letter had entrusted to a friend who had left on a ship for Ormuz jewels of the value of 4000 Venetian ducats, but the jewels were lost. He believed that his friend was murdered. "But such losses," he adds, "will occur." Another time he lost more than 6000 ducats in gold in Portuguese vessels going to Ormuz, and on another occasion he suffered great loss when Pegu was sacked by the King of Burma.

These notes may serve to illustrate the conditions of trade in the glorious days for Portugal when fine fortunes were heaped up in Lisbon through trade, but the great bulk of humanity got very little at least directly through that trade; but we have not exhausted the interest connected with the nature of the outgoing commodities for India, and to that it will be well to return. Another of the stipulations of the treaty of 1513 above referred to was that while duties were to be paid in coin "the Portuguese were to pay for all the pepper and other merchandise they might purchase in kind," and, as the peace led among other things to a dearth of prizes, Albuquerque "was constrained to send an urgent request home for large quantities of merchandise to be sent out to

¹ Danvers, *The Portuguese in India*, vol. i. p. 283.

² P. 34 of the letter referred to as published at Venice in 1824.

³ *Ibid.*, p. 29.

make up for this deficiency.”¹ How long this stipulation remained in force I cannot say, but things were certainly different a hundred years later. In the report to the Grand Duke of Florence above cited we are told that what the Portuguese carry to India for exchange is above all “silver in reals, and besides silver, wine, oil, and some other sort of merchandise, such as coral, glass, and the like, of little importance”; and as to the silver he adds that “the reals bring a gain of more than 50 per cent. as soon as they have reached India, for the real of eight, which in Lisbon is worth 320 reis, in India is sold and spent at the rate of 480 to 484 reis of that money, and with it one buys all sorts of spices and drugs which are sold there, except pepper, which is the monopoly of the King of Portugal and those to whom he gives a lease of that trade.” The importance of silver among the outgoing commodities for India has continued from that time down to the present day, latterly, however, in diminishing proportion. For a long time after the date at which we have now arrived it was as predominant as a means of exchange with India as it was in the first century of the Christian era, when the drain of silver from the Roman Empire to the East was bewailed by the writers of that time. In the voyages of the English East India Company of the four years 1620-23 inclusive the value of the bullion (chiefly silver) sent out to India was £205,710, as against only £58,806 worth of merchandise.²

Now, what is the meaning of the change in the position of silver in Indian trade which seems to have taken place between 1513 and the end of the sixteenth century? No doubt we may see there the result of another change in geographical relations brought about by a discovery nearly contemporaneous with that of the sea way to India—namely, that of the New World. The first result of that discovery of importance to commerce was the pouring into Europe of large quantities of the precious metals, and the quantity was enormously enhanced after the silver mines of Potosi, in Upper Peru (as it was then called), were discovered in 1545. It was probably this discovery that brought it about that of all commodities of such small bulk in proportion to their value as to stand the costs of transport to the East this was the one which could be sent out for most part with the greatest advantage. And this discovery no doubt also helps to explain why that of the sea way to India had so little effect for a very long time in lowering the prices of spices in Europe, why prices even rose. At the time of the return of Vasco da Gama from the first voyage to India the price of pepper at Lisbon is estimated by Danvers³ to have been about 1s. 5d. per lb., and we all know that the immediate occasion of the foundation of the English East India Company about a hundred years later was that the Dutch suddenly raised the price of pepper against the English from 3s. to 6s. and 8s. per lb.

¹ Danvers, vol. i. pp. 284, 286.

² I take these figures from p. 6. of the appendix to P. Colquhoun's *Treatise on the Wealth, Power, and Resources of the British Empire*, 2nd ed., London, 1815.

³ As above, vol. i. p. 64.

But the particular commodity which made up the principal portion of the outward trade to India is, after all, a matter of detail, though not unimportant detail. The main point on which I want to insist is that, whatever the commodities were, whether carried out or home, the nature of the trade with the East was little if at all altered by the discovery of the direct route to India by sea. The trade still continued to be one concerned in a moderate number of articles of small bulk but high value. It was merely a change of route that the Portuguese effected, and for more than a hundred years they remained in sole command of this route. After that, however, they were ousted from the greater part of this trade, and that the more valuable part, chiefly by the Dutch, and from a geographical point of view it is very interesting to note how the Dutch did it. They did not trouble themselves much about India proper. They left the Portuguese alone at Goa, and from that port as a base allowed them to pick up as much trade as they could at Calicut and Cochin, which, said Albuquerque, "were capable of supplying the Portuguese fleets until the Day of Judgment." But Malacca, on the straits of that name, gave command of the route to the further East, whence came in the end even larger quantities of pepper than could be got from India, whence came too ginger, cloves, and nutmegs, as well as the products of China. The importance of this place Albuquerque had accordingly recognised, and in 1511, the year after he took Goa, he took it also by the right that always belongs to the lion as against the jackal. This place was taken by the Dutch (1641), who had previously established themselves on Java and the Spice Islands, where they maintained an absolute monopoly. Ceylon, again, was (and is) almost the only place from which the true cinnamon was to be obtained, so the Dutch took that island also from the Portuguese (1656). As long as the Portuguese were the sole Europeans in the East, Calicut and Cochin not merely furnished the Portuguese with Indian wares, but were important entrepôts for the spices, perfumes, drugs, and jewels of the further East as well as of Chinese silks and porcelains; but the trade in these commodities could be wholly or largely diverted to places in the possession of the Dutch. Even before the capture of Malacca and Ceylon a Portuguese viceroy had reported (1638) that the Dutch had a monopoly of trade from the Bay of Cochin China to the point of Sunda.

But this change also was little more than a change of route. The general character of the Eastern trade remained the same. The English East India Company, whose operations, through the hostility of the Dutch, came to be restricted to India proper, there founded a trade that gave much more opportunity for expansion under modern conditions than that of the Dutch, but for a long time it retained the same character. All the commodities enumerated by Colquhoun as brought back by the voyages of 1620-3 in exchange for the bullion and merchandise sent out were pepper, cloves, mace, nutmegs, Chinese and Persian raw silk, besides calicoes, the sole manufactured article, and one of course that had relatively a much higher value than now, when the direction of the trade in that commodity is reversed.

A similar character for a long time belonged to the trans-Atlantic

trade, even though the costs of transport in that case were less, and favoured the development of a trade in somewhat bulkier commodities. Furs from the Far North, tobacco from Virginia, sugar and afterwards coffee and cotton from the West Indies, were by far the most prominent imports. It was the tobacco trade of Virginia that first enabled Glasgow, which at the time of the Union of the English and Scottish Parliaments was an insignificant town with less than 13,000 inhabitants, to convert itself into a seaport, and thus lay the foundations of its subsequent prosperity. Now tobacco makes up less than 1 per cent. of the value of the goods imported at Glasgow, and, though that may be partly due to a diminution in the actual quantity of tobacco imported at Glasgow, this result has chiefly been brought about by changes in relative values. A hundred years ago the value of the imports into Great Britain and Ireland from the British West Indies was about one-fourth of the total value of the imports from all parts; now it is less than 1 per cent. of that value.

What has brought about such changes, what makes the essential difference between recent and all previous commerce, is the series of enormous improvements in the means of communication which followed so closely on the invention of textile machinery and the improvement of the steam-engine in this country. These improvements have had two important effects on commerce. First, they have facilitated the maintenance of order and security both by land and sea, and thus enormously reduced the risks of commerce. Secondly, they have directly lowered the cost of transport for different goods in different degrees. Bulky goods of little value could now for the first time be profitably conveyed many hundreds of miles by land to a seaport, and there load ever larger ships for distant shores, thus opening up markets with vast undeveloped resources in the heart of great continents. Along with these bulkier goods the more valuable goods are carried at a cost far below that of former times, so that for such commodities as pepper the mere freight is almost a negligible item.

At the present day there can be no doubt that in point of quantity the spice trade is much larger than it ever was. If Venice could get the whole of that trade into her hands, a thing which she never had, notwithstanding the patriotic boast of Doge Mocenigo, the trade would not now bring her a tithe of the wealth which it brought in the days of her grandeur. Much has been said of the sudden "fall" of the Portuguese and Dutch in turn, and that fall has often been explained by mistakes in method. "The fall of the Dutch colonial empire resulted," says Sir William Hunter, "from its short-sighted commercial policy. It was deliberately based upon a monopoly of the trade in spices, and remained from first to last destitute of sound economical principles."¹ But one may well ask, Did the Dutch ever fail in a manner for which they were in any way responsible? It is true that the Dutch East India Company did not supply as many people as they could with the spices of which they held the monopoly. But that was not their aim. It is true that

¹ *Imperial Gazetteer of India*, 2nd ed., vol. vi. p. 362.

they did not build up a great empire like that of the English East India Company. But neither was that their aim. Their aim was to declare dividends, and dividends they declared. The profits of the company down to 1720 averaged 20 per cent. per annum, never sinking below 15 per cent., and sometimes rising to 50 per cent. If spices ceased to enable them to declare such dividends that was not their fault. It was James Watt, George Stephenson, William Symington, and Robert Fulton, who, without intending it, and without being able to foresee what in this respect they were destined to do, sucked the value out of pepper, and that in a manner which neither the strength of armies nor the subtlety of statesmen could have done anything to prevent.

Now the countries that offer the most attractive markets for the greatest quantities of goods of all kinds are no longer those which look to the spice trade or to trade in any specially valuable commodities for their enrichment, but those which abound in coal so placed as to develop a great amount of manufacturing industry, an industry engaged for the most part in working for the million, not merely in producing the luxuries of the rich. The commodities of very small bulk in proportion to their value now have a comparatively insignificant place in commerce. The precious metals and precious stones still indeed retain a good deal of their former importance. But very few vegetable or animal products can be put in the same category. Rubber, indeed, may be reckoned as one, and very handsome profits are reaped from some rubber estates. But every one knows that such exceptional profits can be reaped only for a short time. Of animal products ornamental feathers are the most valuable in proportion to their bulk. Egrets' feathers, I believe, are seldom worth less and often worth a good deal more than twice their weight in gold, but ornamental feathers altogether make up less than a third of 1 per cent. of the total value of British imports.

Perhaps the greatest feature of modern commerce is the unparalleled manner in which it has promoted the increase of population nearly all the world over. Rendering it possible for manufacturing and commercial peoples to depend in a very large measure for their very means of subsistence on supplies brought from the ends of the earth, it is rapidly pushing the settlement of vacant land to the base of the mountains and the edge of the desert. Fifteen years ago Professor Bryce said, "We may conjecture that within the lifetime of persons now living the outflow from Europe to North America will have practically stopped."¹ We are at least nearing the time when the "new lands" of this earth in the temperate zone will all have been allotted. The results of such a check to expansion after a long period of stimulation to expansion must be momentous, but what the nature of these results will be I for one confess that I am unable to foresee. I am, however, convinced that, if we are to be enabled to make any probable forecast as to the course of future development, one of the most important aids to that result must consist in the study of the relations of geography and history

¹ "The Migrations of the Races of Men considered Historically," in the *Scottish Geographical Magazine*, 1892, p. 419.

from the point of view which I have endeavoured to indicate. To study these relations merely with reference to the immediate causes and effects of wars and treaties gives little real insight into the working of geographical influences in history. As in the study of the human body medical men have recognised the necessity of ascertaining with the aid of the microscope the normal functions of the cells of which the body is composed, the pathological states that interfere with their normal working, and the effects on one part of the body of minute disturbances of function in another part, so in tracing the course of history it is becoming more and more recognised that the minute gradual silent changes must be inquired into and taken into account, not merely in relation to the regions in which they take place, but in relation, it may be, to regions far distant. Such studies, it is true, are not confined to the geographer. In them, indeed, the geographer must seek the aid of workers in other fields; but there can hardly be a doubt that it must help greatly towards arriving at a sound solution of the problems presented to keep steadily before one the geographical point of view. The field for such studies is of course immense, the material perhaps not all that could be wished; but I can imagine no task more delightful for those who have the opportunity to engage in it than that of seeking out and examining from that point of view such material as actually exists.

THE PLACE OF ORIGIN OF THE MOON—THE VOLCANIC PROBLEM.¹

By PROFESSOR WILLIAM H. PICKERING, Harvard University.

(*With Illustrations.*)

IN 1879 Professor George H. Darwin propounded the view that the Moon formerly formed a part of the Earth. That it was originally much nearer to the Earth than it is at present, and is now slowly receding from us, was clearly shown by his equations. After considerable discussion, his conclusions have been accepted by the great majority of astronomers, although many of the geologists do not view them with favour. Assuming the correctness of his hypothesis, it will be of interest to determine, first, if possible, from what part of the Earth the Moon originated, and, second, to follow out our conclusions on this point and see to what results they may lead.

When the separation took place, it has been shown that the combined planet was not very much larger than is the Earth at present. It must therefore have been mostly in the solid or liquid condition. If in the latter state, it is obvious that no indication of the Moon's former place could be found at the present time. Very few astronomers or geologists to-day, however, believe that the Earth ever was completely

¹ Reprinted, with the author's corrections and additions, from *The Journal of Geology*, xv. 1 (1907).

liquid. It has probably always been partly solid, partly liquid, and partly gaseous. It is composed of such diverse materials, and these are exposed at different points throughout its volume to such diverse pressures, that, unless we assume it to have condensed from a highly incandescent nebula, which is unlikely, we should scarcely expect it ever to have presented a uniform liquid surface.

The surface was probably hot, but how hot we have no means of knowing. Beneath the surface, however, where radiation was impossible, much higher temperatures were found, as is still the case, and in what follows we shall assume that the interior was practically liquid, or was ready to become actually so where relieved of the pressure due to the gravity of the outer layers; that is, where the centrifugal force became sufficiently high, as in the equatorial regions. Precisely how the Earth came into its present form, whether by planetesimal condensation or otherwise, does not concern us here. We merely assume that in these early days the Earth was in much the same condition that we find it at present, except that it was hotter. We also assume that it was slowly condensing from a more bulky form, rendering fission possible.

These processes of fission and condensation we see going on all around us at the present time in the stellar universe, as indicated by the variable stars of short period and the spectroscopic binaries. It therefore requires no great stretch of the imagination to conceive that it may also have occurred on a smaller scale in the case of our Earth and Moon.

It does not follow, however, that our combined planet was ever incandescent. Indeed, this seems to be unlikely. A cold nebula which is later to condense into a sun must almost necessarily be composed largely of solid matter. The electric disturbances by which we see it, illumine only the gaseous portions, but the metallic elements must be there nevertheless, all the time unseen.

Assuming then a hot, solid, ellipsoidal Earth, with an interior more or less liquid, at least beneath the Equator, revolving on its axis once in about four or five hours, we have a picture of our as yet moonless planet as conceived by the astronomer. As it continued to cool, vast volumes of steam and other gases escaped from its interior into space, increasing its density and diminishing its volume.

As its volume diminished, its speed of rotation increased, until by centrifugal force, as explained by Darwin, the Moon was born. If the crust was solid, and if the Moon escaped from it, it is almost certain that a scar of some sort would have been left, and it is of interest to see if we can find it.

The specific gravity of the Earth as a whole is 5.6. That of the surface material ranges in general between 2.2 and 3.2, with an average of 2.7. The specific gravity of the Moon is 3.4. This indicates clearly that the Moon is composed of material scraped off from the outer surface of the Earth, rather than of matter obtained from a considerable depth. At the same time, the specific gravity 3.4 indicates that the layer of material removed had an appreciable thickness.

As is well known, the land and water are very irregularly distributed over the surface of our globe. If we erect a perpendicular from a point situated one thousand miles to the north-east of New Zealand, and view the Earth from a distance in this direction, we shall find that very little land will be visible, while the outline of the Pacific will approach the form of a circle.

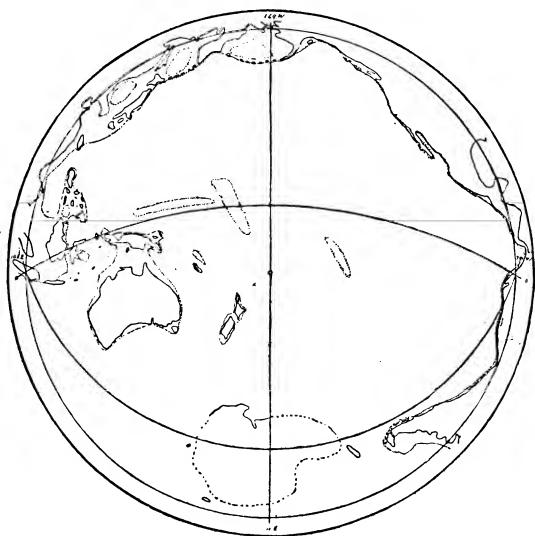


FIG. 1.

Figure 1 is a map of the globe on zenithal projection, where the radii are proportional to the actual distances represented. There is no distortion, therefore, in the radial direction, and the exact shape of the Pacific with regard to a great circle is clearly shown. The inner circle represents the circumference of the globe, and is therefore 90° from the central point. The latitude of this point is 25° S. Away from the centre the tangential distances necessarily become more and more distorted, the distortion at the circumference making them appear $\frac{\pi}{2}$, or 1.6 times too large.

Figure 2 is taken from Gilbert's *Continental Problems of Geology* (Smithsonian Report, 1892), p. 164, and is founded on the results of the Challenger Expedition as deduced by Murray. In it ordinates represent feet, and abscissæ areas, the extreme abscissa representing the total area of the Earth's surface. This area is composed chiefly of two plateaus: one the continental, whose mean altitude is 1000

feet above sea-level; the other the oceanic, whose mean altitude is -14,000 feet.

It will be noticed that the edge of the continental plateau is below sea-level, but not more than 1000 feet below it. This contour may be taken, therefore, as the true boundary more properly than the water-line itself. In Fig. 1 it is indicated by a dotted line. Its position near the Antarctic continent is unknown. The location of the latter, excepting where indicated by the full line, has not been determined. The line composed of dashes therefore indicates its maximum possible area.

If we travel north 90° from the central point of Fig. 1 to the immediate vicinity of Bering Strait, and erect another perpendicular, from which we again examine the globe, we shall obtain a view resem-

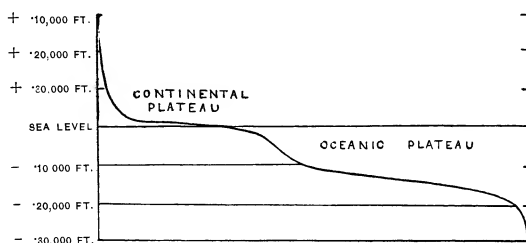


FIG. 2.

bling Fig. 3. In this map, which is drawn in orthographic projection, there is no tangential distortion, and the appearance is that which the Earth would have if seen from a great distance. The horizontal line is a meridian; the vertical is a projection of the inner circle shown in Fig. 1. The continents and islands at the edges of the disk have been allowed to project out beyond the ocean beds in order to make more evident the systematic grouping of the continental masses on one side of the globe. With the exception of Australia, the Antarctic continent, and a small part of South America, all represented in the lower half of Fig. 1, there is no important land on the water side of the globe, not shown in Fig. 3.

An inspection of this figure shows that the Earth's centre of gravity, which is the centre of the circular arcs, does not coincide with its centre of volume, and this deviation would be still more marked were the mobile portions of the surface—*i.e.* the oceans—drawn off. The centre of gravity would then be moved slightly to the right in the figure, and the centre of volume still more so. The ocean side of the solid Earth has obviously a higher specific gravity than the continental side.

It is the general opinion among geologists that the continental forms have always existed—that they are indestructible. How, then, could they have originated? We know something of the permanent surface features of three bodies in the universe besides the Earth, namely, the Moon, Mars, and Mercury. None of these shows us anything resembling

the irregular terrestrial distribution of the high-and-low-level plains of our continents and oceans.

If we examine more minutely the coasts of our great oceans, we shall find the Pacific bounded by a nearly continuous line of active or extinct volcanoes, and this is true whether in North or South America, Asia, the East Indies, New Zealand, and Antarctica. The only possible break is the east coast of Australia, but even here there is a line of volcanic islands, lying a short distance off the coast, stretching from New Guinea more than half-way to New Zealand. The coasts of the Pacific are

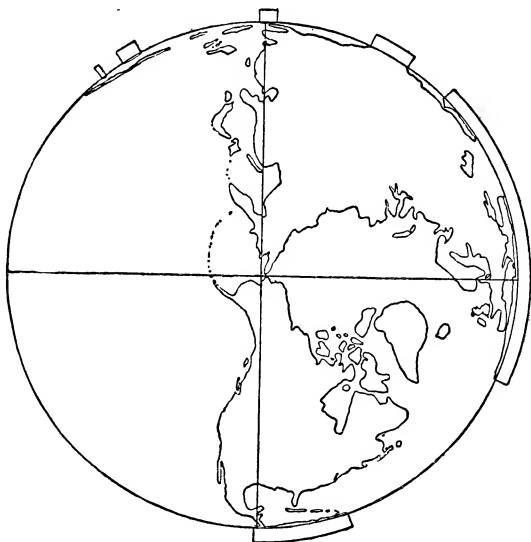


FIG. 3.

generally mountainous and abrupt, and composed of curves convex toward the ocean.

The Atlantic coasts, on the other hand, are generally low, flat, and composed of curves as often concave as convex. As to volcanoes, they are few and scattered. The only conspicuous exception to the general rule is the range of the Lesser Antilles, which both in form and volcanic nature reminds us of the Pacific coast of Asia. The Indian Ocean resembles the Atlantic, except where it approaches the vicinity of the Pacific, and there the characteristic volcanoes again appear.

A curious feature of the Atlantic Ocean is that the two sides have in places a strong similarity. Figure 4 is drawn in globular projection, which is used so frequently for the hemispheres in ordinary atlases, except that in this instance the projection is carried over the Pole on to the other side. This projection gives very little distortion in the

vicinity of the central meridian, which is the portion of the map to

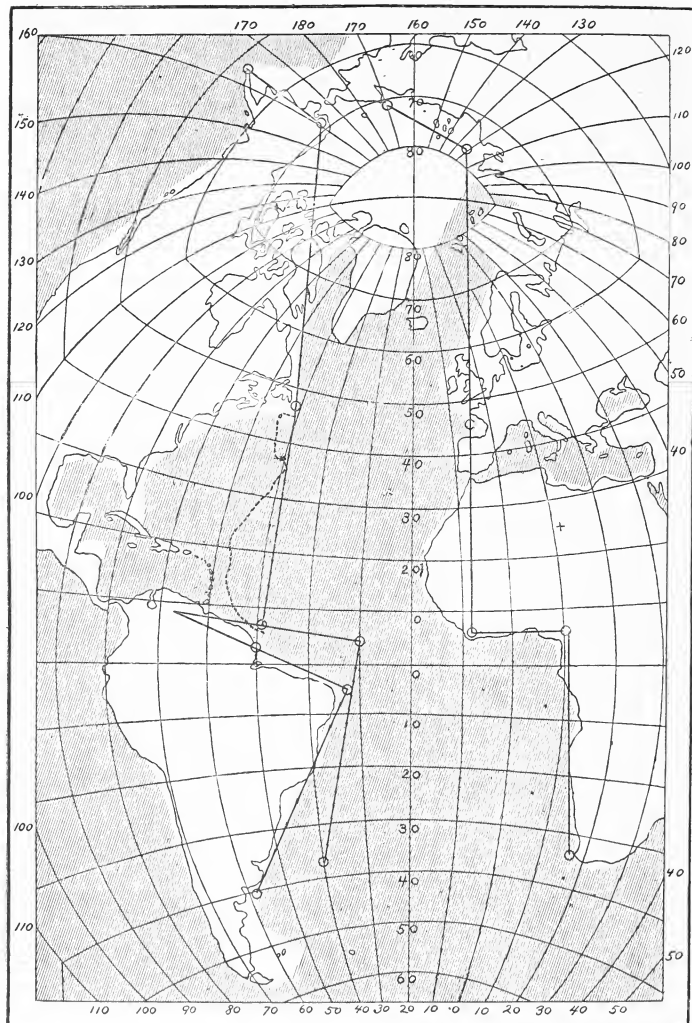


FIG. 4.

which we shall especially refer. The shaded areas represent those parts

of the ocean that are more than 1000 feet in depth. Regarding the unshaded area between America and Asia we have no information.

When the Earth-Moon planet condensed from the original nebula, its denser materials collected at the lower levels, while the lighter ones were distributed with considerable uniformity over its surface. At the present day we find the lighter materials missing from one hemisphere. The mean surface density of the continents is about 2·7. Their mean density is certainly greater. We find a large mass of material now up in the sky, which it is generally believed by astronomers formerly formed part of our Earth, and the density of this material, after some compression by its own gravity, we find to be 3·4, or not far from that of the missing continents. From this we conclude that this mass of material formerly covered that part of the Earth where the continents are lacking, and which is now occupied by the Pacific Ocean. In fact, there is no other place from which it could have come. Who it was that first suggested that the Moon originated in the Pacific is unknown. The idea seems to be a very old one. The object of the present paper is to find what support for this hypothesis is afforded by the results of modern science, when examined both qualitatively and quantitatively.

The volume of the Moon is equivalent to a solid whose surface is equal to that of all our terrestrial oceans, and whose depth is thirty-six miles. It seems probable, therefore, that at this time the Earth had a solid crust averaging thirty-six miles in thickness, beneath which the temperature was so high that the materials were in places liquid, and in other places only kept solid by the enormous pressure of the superincumbent material. When the Moon separated from us, three-quarters of this crust was carried away, and it is suggested that the remainder was torn in two to form the eastern and western continents. These then floated on the liquid surface like two large ice-floes.

If their specific gravity was the same as that of the Moon, 3·4, since the continental plateau averages nearly three miles higher than the ocean bed, the specific gravity of the liquid in which they floated must have been 3·7. Later, when this liquid surface cooled, the huge depression thus formed was occupied by our present oceans.

The volcanic islands in the oceans, such as Hawaii, were obviously formed after the withdrawal of the Moon, and are analogous to the small craters scattered over the lunar *maria*. While their surface material presents no extraordinary density, the lava being full of bubbles and small cavities, interesting results have been obtained by the Coast Survey with the pendulum. Observations were made by E. D. Preston near the summit, and on the slopes of Mauna Kea, Hawaii, at altitudes of 13,060, 6660, and 8 feet. He writes:

"It appears that the lower half of Mauna Kea is of a very much greater density than the upper. The former gives a value of 3·7 and the latter 2·1, the mean density of the whole mountain being 2·9. This is somewhat greater than that found for Haleakala [a neighbouring volcano] and is notably larger than the density of the surface rocks. Indeed, this appears to be the highest value yet deduced from pendulum work."¹

¹ *American Journal of Science*, vol. cxlv. (1893). p. 256.

The remark of Major Dutton¹ is interesting in this connection, that a part of the bulk of these mountains is due to accumulation, and a part to uplifting. The upper half is clearly due to matter, chiefly scoria, which has been expelled from the various vents. The lower half is probably due to the slow uplifting of the former ocean bed.

It would seem as if borings carried on in this vicinity to a depth of only a few hundred feet would bring to the surface the same kind of rock material that, beneath the continents, would only be found at a depth of many miles. Presumably this material would turn out to be lava similar to that found on the surface, save that under the great pressure the innumerable little cavities, rendering the material generally so porous, would have practically disappeared. The fact that its density, 3.7, as determined by Preston, coincides with the theoretical value just deduced is of interest.

Turning now to Fig. 4, six points indicated by circles have been marked along the coastline of the eastern continent. Corresponding to these, six similar points have been marked along the American coast. The two broken lines joining these various points are slightly inclined to one another, but the other small differences in relative position and distance are apparent and not real, being due to the necessary slight distortion of the map. The South American continent does not fit well into this arrangement, and does not appear to have remained perfectly parallel to North America during its transit across the fiery ocean, in obedience to the pull of the Moon. Instead, it seems to have rotated slightly, as shown, about a point somewhat to the east of the Isthmus of Panama.

In trying thus to match the continents together, we must take the outline of the continental plateau rather than the coastline. Five-sixths of the area of the Atlantic basin is thus very well accounted for, but there still remains a considerable area east of the United States, together with the Gulf of Mexico, and the Caribbean and Mediterranean Seas, not explained. The eastern outline of the Atlantic area is indicated by the dotted line.

The action that took place was then somewhat as follows. As the part of the Earth's crust near the present islands of New Zealand began to rise, in obedience to a centrifugal law developed by the Earth's rotation, the crust on the opposite side cracked and split in two, forming the bed of the Atlantic Ocean. Before the crack could widen more than two thousand miles the pull became so intense that a huge, roughly circular piece, forming nearly three-quarters of the Earth's whole crust, was taken out of the middle, and carried away to form the Moon. This left a continent on each side of the Pacific. Thus the Atlantic bed was formed only a few moments before that of the Pacific, and the necessity for two chief oceans instead of one is made fairly apparent.

The antipodes of the central spot in the map of the Pacific is indicated by the cross in Northern Africa. If the ultimate releasing force which caused the disruption of the Moon was, as has been

¹ *U.S. Geological Report*, 1882-83, p. 195.

supposed, the solar tides, we should expect that a certain amount of material might escape from both sides of the Earth. If the Sun were overhead at the central point in the Pacific, then within less than an hour, using Darwin's rate of rotation, it would have been exactly opposite to the area in question in the Atlantic, Gulf, and Caribbean Sea.

The similarity of the Lesser Antilles to the Asiatic islands, already pointed out, corroborates this explanation. It is also to be noted that the greatest depths in the Atlantic, 21,000 feet, are found along the eastern boundary of this region. Similarly, one of the deepest parts of the Pacific, 31,000 feet, is indicated by a dot close to the central point on the map, Fig. 1. Around this deep portion on the east, north, and west is a shallower area from 15,000 to 20,000 feet in depth, and then, as we approach the continents, again a deeper area.

All those who have studied the stratification of the Appalachian region have concluded that the sediments came chiefly from the east. The geologists also tell us that it is certain that a continental area, narrow at the north and widening at the south, formerly existed to the eastward of the United States. This area they believe to have sunk beneath the ocean in more recent times. One or the other of these two explanations is probably correct, and perhaps they both are true. Either would account for the greater breadth of the Atlantic at this point.

There are several coincidences relating to the position of the central point of the Pacific which may or may not be accidental. The close coincidence with the very deep area above noted is the first of these. The second relates to its latitude, -25° . This is within a degree and a half of the tropic of Capricorn. The tropics are the lines on a uniform sphere where the direct solar tidal pull acts for the greatest length of time on any particular area of rock. Here also the leverage of the tidal pull on the Earth's crust would be greatest in displacing a protuberant equatorial ring. If the Moon were generated from the Earth by centrifugal force, liberated by the tides, we should expect the central point to coincide with one of the tropics of that time. The coincidence with the present tropic would indicate that the axis of the Earth can have changed very little in the meantime. The third and fourth coincidences are more likely to be accidental. The third is that the central point coincides in longitude with Bering Strait, where the two continents are supposed to have slipped past one another. The fourth is that the strait is almost exactly 90° , more accurately 91° , in latitude from the central point.

If the greater continents were split apart, we should by the same analogy conclude that Antarctica and Australia were drawn from the Indian Ocean; the former from the vicinity of the Cape of Good Hope, the latter farther east.

If it is true, as here suggested, that we owe our continents to the Moon, then the human race owes far more to that body than we have ever before placed to its credit. If the Moon had not been formed, or if it had carried away the whole of the terrestrial crust, our Earth would have been completely enveloped by its oceans, as is presumably the case

with Venus at present, and our race could hardly have advanced much beyond the intelligence of the present deep-sea fish. If the Moon had been of but half its present bulk or had been slightly larger than it is at present, our continents would have been greatly diminished in area, and our numbers decimated, or our lands over-populated.

Connected intimately with the origin of the continents is the problem as to the cause of volcanoes, and why they are at present always situated near the sea. A point that is of the utmost consequence in its bearing on this question is the fact, noted by Charles Darwin, that active volcanoes are found only where the coastline is rising. Clearly the same cause produces both effects.

A rising region, as pointed out by Dutton, must evidently be increasing its volume. This increase may occur either with or without an increase of mass. In the latter case the increase must be due to a rise of temperature. It has been shown that, if a part of the Earth's crust fifty miles in thickness were to have its temperature raised 200° F., its surface would be raised to the extent of 1000 to 1500 feet.¹ The Bolivian plateau has an elevation of two and a half miles. That of the Himalayas is about a mile higher. It is improbable that these elevations are due to this cause.

The alternative is that in the rising regions we have an increase of mass. If the mass were increased materially, it has been shown by Gilbert² that the hot subterranean region should yield to the added pressure, thus neutralising the elevation. An added column of rock two miles in height could not possibly be supported. Apparently our last resort is to introduce some lighter material, such as water or steam. The pressure on the steam, if its temperature were above the critical point, would be so great that its density would be but little less than the equivalent extrapolated value for water. It might have one-fourth of the weight of an equal column of rock.

Liquid lava is full of water, and as the lava cools the water is expelled from it. The lava at Hilo, Hawaii, contains innumerable bubbles, indicating the presence of steam, which had been retained by it within its structure for many days, ever since it had left the crater of Mauna Loa, fifty miles distant.

Since volcanoes are intermittent in action, the charging process must still be going on at the present time; otherwise there would have been one long discharge in the distant past, which would have rendered all our present volcanoes extinct.

Since volcanoes are active only near the oceans, it has been suggested that the eruption is due to sea water that has entered by cracks in the Earth's crust and is subsequently discharged from the volcano. Volcanoes do discharge salt water, but the solid ingredients of the water do not occur in the same proportions that they do in the sea. Some of the sea salts are often found to be absent, while other salts are often found that do not occur at all in sea water. This fact, together with the inherent

¹ Judd, *Volcanoes*, p. 347.

² *Continental Problems of Geology*, Smithsonian Report, 1892, p. 165.

improbability that sea water should be sucked in at a low level and pumped out at a high one, renders this explanation improbable.

Another explanation of the universal presence of water in volcanic products is that it is derived from rain water, which has percolated down through the soil. This theory, however, does not account for the fact that volcanoes are always found near the sea. Neither of these theories account for the gradual elevation of the land in volcanic regions.

Since the process of charging volcanoes with steam is still going on, and since it appears that the necessary water is not derived from either the sea or the atmosphere, the only alternative seems to be that it comes from the heavy stony material forming the ocean beds, and does not come in appreciable quantities, at present, from the lighter material forming the continents. It is evident, however, that this lighter material is sometimes cracked, permitting the discharge to take place through it. This was the case with the extinct volcanoes in Central Europe, and those near the Yellowstone Park and Arizona in this country. The volcanoes at present active in North and South America seem to rise from what was probably formerly the edge of the continental plateau.

The next question that arises is: From what depth does the lava come? Judged by its temperature at the vent, unless it becomes heated by friction, by compression, or by radio-activity on its way to the surface, which seems improbable, it must have come from a considerable distance. The rate of increase of temperature with the depth varies in different parts of the world from 20 to 100 feet per degree Fahrenheit. It may fairly be taken near the surface at 100° per mile of depth. From its surface temperature, Bonney estimates¹ that "the lava is generally supplied from a zone situated at a depth of from 20 to 25, or possibly to 30 miles, in the crust of the Earth." Computed from the speed of travel of earthquake waves, Fischer and Milne have placed the thickness of the crust at about 30 miles.² Judged by the amount of radium contained in the igneous rocks of the earth's surface, and the total quantity which the earth can be assumed to contain, Strutt has computed the thickness of the crust to be about 45 miles. It is interesting to note that the thickness that we have found dependent on the volume of the Moon—36 miles—lies well within these values. It is certainly gratifying that four computations based on such dissimilar data should all lead to so nearly the same result.

Daubrée has shown³ that water separated from a chamber filled with steam at a temperature of about 160° C. by a close, fine-grained sandstone, passed through the slab with ease, against the outward pressure of the steam. He also found that the facility with which the water found a passage was increased by heat. There is therefore no difficulty in understanding the transmission of water through hot rocks at considerable depths. Its presence, moreover, would tend to lower the melting-point of the rock, and make it more viscous.

¹ *Volcanoes*, p. 284.

² Milne, *Seismology*, p. 120.

³ *Geological Experiments*, vol. i. p. 237.

A certain amount of water may even be transmitted in this manner down through the ocean floors; but when we consider that the transmitting medium consists of cold rock several miles in thickness, the water advancing against a constantly increasing pressure, it does not seem that the amount transmitted per year in this manner can be very large.

In our hypothesis explaining the origin of the continents, it was stated that they were composed of the crust which was either originally solid or else had already cooled sufficiently to become so. They had therefore expelled a large part of any water which they may originally have contained. The ocean beds at the time of the great catastrophe were liquid. They therefore absorbed all the water available, if indeed they were not already saturated with it. They had a much higher temperature, having come from a greater depth, and contained much more water at this period than the continents, and, it is believed, have been giving it out as they cooled ever since.

Doubtless the hot bases of the continents have absorbed some water from the ocean beds as the latter cooled, and the expansion and diminished specific gravity thus caused would tend to elevate them in the vicinity of the oceans. This has occurred notably in the vicinity of the Pacific, the whole of whose coasts are at the present time in a state of elevation. We can understand also that the systematic difference in material and density, extending over large areas, would render the boundaries of the continents more subject to cracks, with their resulting volcanoes and earthquakes, than other portions of the Earth's surface. A zone of territory subject to earthquakes extends around the Pacific.

As is known from its rigidity, the interior of the Earth as a whole is solid. There cannot even be at present a continuous liquid surface between the centre and the crust. Beneath every active volcano, however, there must be an area from which its lava is derived. In some way, without doubt by the contraction of the Earth, this lava is caused to approach the surface, and on the way it gradually changes from a viscous solid to a viscous liquid. There are only two ways in which this change can take place: one is by an increase in temperature, the other by a decrease in pressure. The latter is probably the actual one.

Tangentially considered, the lower portions of what we may for convenience call the Earth's crust are in a state of compression, the upper portions in a state of tension. Radially all are in a state of compression. Between the upper and lower portions is a neutral surface of no tangential strain. When a crack caused by the tangential tension reaches this neutral surface, the viscous rock oozes up through it, becoming more and more liquid as it approaches the surface and the pressure is diminished. As it melts and is relieved of pressure, its density diminishes, and, if it finally reaches the surface, the erupted lava will continue to flow till the pressure at its source is reduced to equality with the hydrostatic pressure at the base of the crack. The larger the opening and the shorter the distance from the surface, the sooner will this equality of pressure occur, and the shorter be the duration of the eruption. The expansion of the bubbles of steam near the top of the crack diminishes the hydrostatic pressure, and their escape obviously causes the explosions usually noticed.

The violent manifestations are therefore all generated near the surface, as is the case of a geyser.

The uprush and escape of all this material broaden the crack into a tube several hundred feet in diameter. After the lava has ceased to flow, the steam working its way up to the vent still keeps a somewhat narrowed passage open. It thus continues as a line of weakness; and when the flow of steam and viscous rock from below on all sides toward the area of diminished pressure again increases this pressure beyond the breaking strength of the resisting material, the eruption will be renewed.

Volcanoes frequently lie along arcs of circles, which, if complete, would resemble the lunar *maria* both in size and shape. One of the most complete of these series of arcs has the China Sea for its centre, while the volcanoes are found in the Philippines, Celebes, Java, Sumatra, the Malay Peninsula, and Southern China to the west of Canton. The diameter of this circle is 2000 miles. The Japan and Bering Seas are similarly partly surrounded by incomplete arcs. The shape of the latter is decidedly elliptical.

THE JAMAICA EARTHQUAKE.¹

By Professor CHARLES W. BROWN, Brown University.

WITHIN a period of nine months three regions in the Western Hemisphere, geologically closely akin, but geographically distant one from the other, were visited by earthquakes, causing an appalling loss of life and property. In all cases the disasters had been preceded by minor earthshakings for years, and the areas were known to be in zones of earth-unrest. No warning, however, unless the tremors that occur at irregular intervals every month or two could be counted as such, characterised these last disturbances. But these tremors must be regarded as the climax of a long-continued yielding to strain which has resulted in a series of minor breakings. This faulting culminated in a great fracturing of the earth's crust and a consequent destructive earth-shaking. The kindred conditions of these different areas appear to be, first, a considerable amount of differential relief only obtained where mountains are associated with marine depths; and, in the second place, the occurrence of newer and less compacted sediments upon these slopes.

For several months previous to the afternoon of January 14, 1907, there had been no noticeable increase in the number or intensity of the customary slight shocks that occur in the Island of Jamaica every month or two. In Weather Report iv. of Jamaica, Mr. Maxwell Hall has noted some twenty-six minor shocks that occurred from 1880 to 1886, and this number might be regarded as typical of the seismic phenomena in that region. A slight shock was noticed by many in November last, but the memories of the destruction of Port Royal by

¹ See *The Popular Science Monthly*, May 1907.

the historic earthquake of 1692 had been dulled by the interval of two centuries, and the Jamaicans had begun to think themselves in a region of comparative safety. Slight tremors and shocks caused but scant attention or notice on the part of a few of the people. Consequently, when the real cry of "wolf" came, for the first second or so but few realised the danger. The slight tremor, however, instantly increased to a terrible vibration of the earth that threw down great walls and buildings, and inside of a minute transformed the city of Kingston from a prosperous metropolis to a place of destruction and mourning.

In order to appreciate their relative importance and possible influence upon seismic activity, let us notice the topographic, geologic, and bathographic conditions that exist at Jamaica. The etymology of the word Jamaica, originating in two descriptive Indian words meaning "well-wooded and watered," and modified by the Spaniards to "Xaymaca," is interesting, taken in connection with the historic topographic description of the island given by Columbus to Queen Isabella on his return from the West Indies—"a crumpled handkerchief picked up by the middle."

The aptness of the simile cannot be questioned when one sees the many steep knife-edged divides (typical "bad-land" topography) rising abruptly in fifteen miles 7400 feet to the misty Blue Mountain peaks that tower above the small inland valleys, or the narrow plains that fringe the seashore. These plains constitute the very small percentage of the island that is fairly level, and it is upon these plains that the larger towns and the larger plantations of bananas and sugar-cane are found. These level areas are made up of alluvial deposits, fans or sheet-wash brought from the adjacent ragged slopes by the river in flood-time. Upon the rather bare slopes occasional rectangular patches of light green show the location of small banana farms or "pens." But the more abundant and typical tropical verdure is found lower down on the fringing plains. The island has long been known for the abundance and variety of its tropical and subtropical products due to the fertility of the limestone soil and the abundance of the rainfall, which varies largely, however, in amount, from 10 inches at Port Royal to 126 inches some years in the higher regions.

Geologically, Jamaica is of comparatively recent age, for its basal Blue Mountain series of sediments and intrusives is of late Cretaceous and Eocene times. This series makes up the mountainous backbone of the island, while the later Oligocene limestone overlaps the former series in a thick piedmontal formation covering two-thirds of the island. The more recent alluvial and littoral formations were deposited during the period of uniform elevation following, and constitute the fringing plains of the island.

In the structural geology of Jamaica, the earliest axis of folding now evident is the northwest-southeast line of the Blue Mountains, with later eastwest foldings along the more ancient line of orogenic movement which outlined the Greater Antilles in early Mesozoic times.¹ The

¹ See Hill's "The Geology and Physical Geography of Jamaica." *Bull. Mus. Comp. Zool.*, xxxiv., 1899, p. 421.

writer has observed transverse faults in the Blue Mountain region, which undoubtedly indicate lines along which fracture may occur.

M. de Ballore¹ coincides with Mr. Hill's ideas regarding an east-west folding for the Antilles in postulating his theory of an anticlinal axis that marks the line of the Greater Antilles and a parallel synclinal belt immediately to the north of Jamaica, which coincides with the Bartlett Deep.

The bathographic relations of Jamaica are significant. We see that Jamaica and the other Antillean islands are but the higher peaks of a lofty and precipitous, but submerged, mountain chain. The tremendous differential relief of over 38,000 feet that exists in places in the Caribbean region apparently coincides with a zone of seismic and volcanic frequency. We know that the crust of the earth is always in a state of tension. This stress may come from the shrinkage of the earth, from the loading or unloading of the earth's surface through erosion or deposition, or from other sources. The resistance is lessened on a relatively steep slope where the points of application of this lateral pressure at the ends, not falling in the same plane, tend to produce a fracture. When a sudden slip in the adjustment occurs, the resulting jar is transmitted through the earth as earthquake waves.

Port Royal is at the western tip of a narrow seven-mile sand-spit that makes a natural breakwater to one of the finest harbours in the West Indies. When the town was for the most part submerged by the earthquake of 1692, this favourite site was abandoned for the Liguanea plain just across the harbour, and Kingston was founded on the largest of the fringing plains of loosely compacted sands and gravels. And here in this closely built city of 60,000 persons (and at Buff Bay opposite on the north shore) the destruction by the last earthquake was felt most keenly. Eighty-five per cent. of the buildings were injured or destroyed. Then came Kingston's old enemy fire, and swept over ten or fifteen blocks of the business and warehouse section.

The earthquake shock that brought disaster to the island of Jamaica began, according to the regulator of Mr. J. A. Soulette, at 3.33 P.M. Others record its arrival two or three minutes earlier. In various places on the island, as reported by local times, its occurrence varied from 3.20 to 3.45 P.M. In the investigation it was found impossible to plot any coseismal lines, for the reason that no accurate co-ordinated time exists in the island. Since the shock, however, there has been a movement on foot in Kingston to establish a system of accurate time-keeping throughout Jamaica. The shock lasted about thirty-five seconds, varying in length with the location and geological position of the observer. At the east end of the island some noted a duration of sixty seconds; on the north shore a length of ninety seconds, while at other points near by the duration reported was anything from five to forty seconds. The slight preliminary tremors were felt immediately before the main shock, and the noise and roar were heard slightly before the coming of the

¹ *Tremblements de Terre*, F. de Montessus de Ballore, 1906.

major vibrations. One man, used to earthquake countries, hearing the sound from the preliminary tremors, rushed out of doors into the street, only to be thrown toward the west by the violent shaking. He dragged an injured companion a hundred feet or so during the slight lessening of the violent shock, and then felt the second climax of a slow undulating character pass underneath. This experience is like the phenomena of double earthquake shocks which have come to Jamaica in past years, and also has characterised many of the sequent shocks. Another man repeated his actions and found that he could jump through the fallen wall of the house, and then over a low fence and get into the street in about forty seconds. The increase and decrease of the tremors are so gradual that it is very difficult for an observer to tell just when the shock comes and when it ends. From the majority of the testimony it is evident that in this disaster the movement quickly reached the major climax in about ten seconds, then lessened in intensity for about ten more, then gently swelled to a second and minor climax and disappeared in a total of about thirty-five seconds.

While there were apparently no preliminary shocks at Jamaica, there have been many sequent vibrations of the earth more or less severe. The press has chronicled one on February 23, which was the strongest since the earthquake, and another one was also noted on March 22. Mr. Maxwell Hall has noted some eighty shocks after the main shock on January 14 to February 5, several of them shaking the whole island, while others were of local extent. On the early morning of January 28 one small shock awakened me instantly by a slight shaking of my cot in the tent in which we were sheltered. The continuance of the motion gave one a sense of insecurity and unsteadiness, and brought with it a slight tinge of dread and nausea. My first impression upon waking was of a rushing, whistling sound from the south-west; it increased and passed overhead, rapidly lessening and disappearing. It was very similar in sound to the approach and passing of a large flock of ducks flying low. Then from the racecourse, only a quarter-mile distant, and only a short time quieted, came the cries of the frightened negroes and the howls of the numerous dogs with which Kingston is cursed, and the crowing of the many roosters in the trees—as they did about every hour during the night. The shock felt on board the moving Port Antonio train produced a feeling as if the coaches were running upon the sleepers, and at the same time swaying so much that it seemed as if they would topple over to the south-west. No damage, however, was done to any of the rolling stock or to the roadbed. In none of the many tunnels was any displacement observed. A man driving on the road suddenly felt his vehicle thrown in an angling position across the road, and it seemed difficult for the horse to keep its footing. It was observed, however, that motion sometimes counteracted the vibration of the ground and made the latter imperceptible.

From the data available, the dependence of earthquakes in intensity upon topography is well emphasised. Loosely compacted fringing and alluvial plains extended the intensity farther than the more compact and elastic mountain regions. Not only do these less elastic plains give

a greater amplitude to the waves and cause greater destruction, but apparently the earth-waves are affected by plains indented in hills as sea-waves change their direction in entering the arm of a bay. In the middle of the Hope River Valley at Mona plantation, an observer noticed the motion pass him and then saw the landslide occur at the mouth of the river to the southward. As the wave passed over the cane-fields, a motion was observed similar to that produced in a field of grain by the wind. The direction here was at right angles to the path of the wave-motion only five miles away at Kingston, situated on the western slopes of Long Mountain. The motion approached the island from the south-west, changing on the land its direction and intensity with the change in the nature of the material through which it passed. In the lower part of the city of Kingston the path of the movement was well marked by the overthrowing of walls, piers, statues, monuments, large chimneys, and a similar movement towards the east of even large marble slabs covering graves. Northward from the city the motion appeared to come more from the south, and the northern walls showed the greatest damage; and westward, the path of motion appeared to swing so that it came from Kingston. The absence of any large buildings away from the villages and cities made the plotting of directions rather difficult, for the lightly-built mud-wattled huts were not affected by the shock, and tests by hearing are very unreliable. But there was a general diminution in intensity away from Kingston; this decreasing rapidly eastward and less so to the north. Haiti did not feel the shock, neither was it felt at Colon or at Grand Cayman, 175 miles west, but Santiago, 120 miles north, experienced a slight shock.

Cracks in buildings, which at Kingston dip some fifty degrees east, are always perpendicular to the path of the emergence of earthquake waves. Hitherto, the intensity area and epicentre have been regarded as synonymous. But the dip of the angling cracks at Kingston points to a locus of disturbance much to the west of that city, while the lines of isoseismals indicate the intensity area in the western half of Kingston. It may readily be imagined, then, that the area of greatest destruction may not be directly above the focus. Suppose a highly elastic rock is there situated, and some distance away is found a plain of loosely-formed material. The destruction in the latter area will far exceed that in the former in spite of its favourable location. Until we register the actual amplitude, wave-length, and period, and, with the elasticity of the rock underneath, calculate from the more readily discerned data on adjacent but less elastic media the changes that have occurred in the wave-motion, it will be difficult to determine with accuracy in a region of rocks of widely varying elasticity the location of epicentres. For outliers of rock in plains must deflect, refract, and reflect wave-motion and even shadow-areas in these plains. The only conclusion then is that the east end of the Liguanea plain was the nearest area to the real epicentre that by nature of material would give the greatest amplitude to the destructive epifocal waves. Further, the angle of emergence at Kingston co-ordinated with the proximity of a

probable epicentre, together with the limited area of disturbance, indicates a shallow origin of about three miles.

The line of intensity of the earthquake destruction apparently extended to a greater distance northward than to the east or west. For at Buff and Annotta bays on the north shore the destruction was but little less than at Kingston. Furthermore, the shock was felt at Santiago to the north, and not at Haiti to the east or on land to the west of Jamaica. The inference is that the locus of the disturbance originated in a line of north-south faulting rather than in an area of less linear extent. The north-south faultlines extending throughout the island, and some probable faultlines extending in a similar direction through Cuba (marked by sharp valleys) may indicate in a general way the direction of possible faulting at the present time. It may be noted that this line of faulting lies at a considerable angle with the general trend of the Antillean folding. The beautiful mountain road from Kingston to Newcastle was in the line of greatest intensity. But though spurs showed considerable destruction, and in places the road slipped off the face of the steep slopes, or portions of the hills slipped down on the road carrying it away or obliterating it by landslides in many places, yet the destruction was caused more by the unstable position of the road, or of these masses of earth, rather than by the intensity of the shock. At Newcastle, moreover, the buildings were for the most part not damaged to any great extent, except as their location on a terraced slope or on the crest of a short divide would place them in a position of unstable equilibrium. Similar destruction might be caused by a severe rainstorm, or, in the northern countries, by frost action as well as by earthquake waves.

From the investigation of the many cracked walls at Kingston, the amplitude of the wave motion (as one might expect on alluvial foundations) was considerable. Spaces from half an inch to two inches were left in massive walls. Floors and ceilings were pulled from the shallow supports in many cases and caused destruction in more instances than would have been necessary had there been greater foresight in the manner of building. From an open circular well of masonry some twenty feet in diameter, water was thrown up some eight feet and over the north-eastern lip of this well. A brick pier in a fence was thrown to the eastward beyond its arc, some two-thirds the length of its radius. At the same place large slabs of marble were moved along on their cement base to the eastward some three inches or more in spite of the attendant friction. The amplitude was probably less than an inch at Kingston.

The speed of the various waves in this earthquake can only be approximated. During a slight shock that occurred afterwards, of about one-third the intensity, from an interrupted telephone conversation from Kingston to Port Antonio, it was estimated that the wave travelled about 2000 feet per second. As yet no data have been available concerning the breaking of the cables, and as to the exact time or speed as marked by such fractures. The Panama cable was broken in two places, one four miles and the other some twenty miles offshore from Bull Bay, but so covered was it with débris that a couple of miles or so of the cable had to be

abandoned. The preliminary tremors were heard before being felt, and probably were slower than sound waves. With the increase of speed that comes with the augmentation of intensity of earthquakes, it is probable that the rate of the major vibrations was about 10,000 feet per second.

As has been previously stated, the shock was a double one; the first climax apparently came from the west, while the second one, less disruptive and more undulating in its character, apparently came more from the southward of Kingston. These two directions of vibration resulted in an almost universal gyratory movement of columns, statues, piers, sections of brick chimneys, and even of buildings, in a counter-clockwise fashion.

Geologically, earthquakes often are not very important. In the case of the earthquake at Jamaica, however, there apparently was a zone of fissuring and subsidence from 100 yards to 300 yards in width. It started at the western part of the city of Kingston, ran along the water front encircling the harbour, and continued along the line of the Palisadoes, reaching its greatest destructive effect at Port Royal. One arm of this fissuring followed up the river Cobre to the carriage road. From soundings taken by the kindness of Mr. Charlton Thomson, harbour-master, it was ascertained that in several places along the edge of the harbour the bottom had sunk from old soundings of one fathom and a half to over six fathoms, and that on the harbour side of the base of the Palisadoes, a series of step-faults reached a maximum depression at the shore to the north of four fathoms. This zone of disturbance continued, as far as could be traced, in an interrupted line along the Palisadoes, and caused a maximum depression at the western tip of Port Royal, where the buildings were tilted by the sinking and 100 yards or more of land were submerged to a depth of from 8 to 25 feet. This fissuring of the earth was caused by the repeated tearing apart and closing of the earth's crust, accompanied generally by the ejection of water, sand, and mud, sometimes to the height of three or four feet, but the subsidence prevented the forming of any cones about these craterlets. The sands first thrown up were afterwards covered by a layer of mud.

To account for the unique line of fissuring and subsidence is difficult. It was noted that considerable disturbance took place at the shoreline where the earth vibrations were refracted in changing from the medium of one elasticity to a medium of a different elasticity. But the middle portions of the harbour were stable and the channel was unchanged, though a beacon light near Fort Augusta was broken off. In this limestone country, solution by underground waters might be sufficient to account for the sinking of a small area like the harbour at Kingston. But the harbour did not sink—only a small encircling zone, and that located either on the shore or slightly offshore. The continuous tearing apart and closing of these fissures, covering a few hours' time as it did in some instances, might account for the hydraulicing of the loosely compacted sands and gravels in the zone of fissuring, and allow for subsidence. Again, ground waters may have caused considerable solution of the limy constituents where the waters entered the harbour.

But no theory as yet satisfactorily accounts for this peculiar subsidence. At the eastern part of the harbour at Rock Fort a considerable change in underground drainage was observed, where a small spring was increased to a stream eight feet wide and six inches deep.

It was here at the Rock Fort Penitentiary quarry that a guard gave me the only reliable account of a sea-wave. After a few moments had elapsed and the convicts had run from the landslides on the face of the quarry and gathered around him for protection, the sea retreated for a hundred feet and then advanced inward upon the shore about sixty feet in a low wave a couple of feet high. Ocho Rios, near St. Anne's Bay, on the north shore, also had its harbour emptied for about seventy-five yards, after which a small incoming wave was followed by gradually lessening oscillations. A careful search ten days later along the other places of the harbour and coastline, however, revealed no trace of any sea-wave, even of slight degree.

Thanks to the energy of the department in charge of the waterworks, and to the good fortune that caused no important breaks in the system, Kingston was shut off from its water supply for only two hours. Some of its cement reservoirs situated near a large wrecked school-building showed no damage. The pipe that carries the city's sewage eastward to the sea at the base of the Palisadoes, however, was broken at several places along the zone of fissuring, and its linear extent, like that of the water pipe along the Palisadoes, was marked by rifting in the earth. A prompt repairing of the breaks in these two systems undoubtedly saved the city from an outbreak of destructive pestilence.

Arches in buildings apparently withstood the shock to a notable degree, whether transverse or parallel to the line of the earthquake motion. Generally when built in houses they preserved the parts around them. The Institute, a building in which some two hundred delegates had assembled in the first session of the West Indian Agricultural Conference, is built on two lines of arches at right angles to each other. The Institute was damaged, but withstood the shock. The great destruction of brick buildings in Kingston was doubtless due to the fact that poor mortar and dry bricks were used in the construction. The mortar generally appeared to be rather porous, and usually the cracks in the wall followed the mortar, though at Up Park Camp, where the bricks were laid in cement mortar, the cracks passed through the bricks.

The streets were narrow, so that the falling wall of even a two-story building would block the street, and many persons escaped from falling buildings only to be crushed in the choked narrow streets. A cement floor may help to preserve a building from destruction. In many cases it could be seen that if the floors had been well tied to the walls and the walls themselves held at the corners, a great lessening of the destruction would have resulted. On account of the white ants, foreign woods are, unless creosoted, difficult to use, but some frame houses showed but the slightest effect of the earthquake shock. The "barrack" or "noggin" structure, much used in earthquake countries, apparently suffered nearly as much as other brick walls.

Jamaica lies in a region of great differential relief and consequent stress. The earthquake was confined in its area of greatest destruction to small limits upon alluvial detrital material, where the amplitude was increased to bring about this effect, varying with the heterogeneity of material. The origin of the shock was comparatively shallow, and the earthquake was local in character. While there was a general distinct rotary motion induced by two components of the vibrations, the major component came from a westerly direction. There were few evidences of sea-waves, but there was a unique zone of fissuring and subsidence about the harbour of Kingston. Finally, the disasters at San Francisco, Valparaiso, and Kingston should teach the lesson that in the case of cities located in a danger zone (where there are many recurring shocks of slight degree), there is always a possibility of the coming of a disastrous shock; that certain types of buildings should be built and streets laid out with that possibility in mind; that water, sewage, and lighting systems should be planned in sections, and that as far as possible a city should not be located nor large edifices erected upon uncompacted rocks and soils.

PROCEEDINGS OF THE ROYAL SCOTTISH GEOGRAPHICAL SOCIETY.

At a Meeting of Council, held on July 19, the following lady and gentleman were elected Members of the Society:—

Miss E. G. Kemp, London.

Captain A. Akin-Higgins.

DIPLOMA OF FELLOWSHIP.

The Council conferred the Ordinary Diploma of Fellowship on Miss E. G. Kemp, Captain A. Akin-Higgins, and the Rev. Alexander M. Sutherland, Members of the Society, who had complied with the prescribed conditions.

SOCIETY'S ROOMS.

The Council also resolved to forward the following letter to the Secretary for Scotland:—

" 29th July 1907.

"Unto the Right Honourable JOHN SINCLAIR, M.P.,

"Secretary for Scotland.

"SIR,—At a Meeting held to-day the Council of this Society requested me to communicate with you, as it was understood that the question of the Society's tenancy of premises in the National Portrait

Gallery, Edinburgh, had been submitted to you by the Board of Trustees under the National Galleries of Scotland Act.

"The Society's tenancy of its premises in the National Portrait Gallery has already lasted for sixteen years, and during that period the Society has annually paid to the Government a rent of £125.

"In the Report of the Departmental Committee, appointed by Lord Balfour of Burleigh when Secretary for Scotland, there is not merely a recommendation that the above rent be remitted, but also the Committee implied that permanency of tenure should be granted to the Society.

"During the twenty-three years of its existence the Society has done much to extend Geographical education throughout Scotland. Its Monthly Magazine is recognised as an important scientific publication, devoting special attention to original research of national interest. Although contributors are not paid, this publication costs the Society upwards of £800 per annum. The Society has always had four centres of activity, situated in Edinburgh, Glasgow, Dundee, and Aberdeen, and its Lectures in all these cities are very largely attended.

"Owing to its exertions, and its desire to meet the demands of its various centres, the Society has annually expended all its available income, and it has been unable to undertake more work or to open new centres throughout Scotland solely for lack of funds.

"In these circumstances the Council appeals to you to keep in view the straitened financial condition of the Society, and its necessity for financial help, if its usefulness is to be continued and remain unimpaired.

"At the present time the Society feels that it would be disastrous to its interests to be forced to leave the premises where it has been lodged for sixteen years. Besides the heavy expenses of removal, the change of its well-known headquarters would be very prejudicial; and the Council ventures to hope that by some rearrangement of rooms it may still be possible to provide in the National Portrait Gallery office accommodation for the Board of Trustees without disturbing the Geographical Society's tenancy.

"If the present tenancy of the Society is to be interfered with, it would be absolutely necessary, in order to prevent serious injury to the Society's important public work, that it should receive an annual grant from Government, and it is calculated that adequate accommodation in a suitable locality could not be provided for less than £300 per annum.

"Seeing that the Royal Geographical Society of London receives an annual Government grant of £500 and has only one centre, a similar grant to this Society in aid of the expenses of four centres throughout Scotland seems reasonable.

"I shall be glad to furnish you with any other information, statistical or otherwise, concerning the Society and its work, and I have the honour to remain, Sir, your most obedient servant,

JAMES GEIKIE, *President.*"

GEOGRAPHICAL NOTES.

ASIA.

The Geology of Japan.—A paper on this subject by Mr. R. Anderson was read recently before the Geological Society of Washington, and from the summary in *Science* (May 24) we select the following points of geographical interest. The Japanese chain of islands is continental in character, and not chiefly volcanic in origin, though volcanic activity has always been a feature of its history. The ground plan of the group was laid in the earliest geological time, for Archæan gneisses and schists, together with a great series of Palæozoic rocks, form the basal complex. On this primitive land mass, rocks of Secondary, Tertiary, and Post-Tertiary age have been superimposed. Geological activity has been always great and has been long-continued, as is shown by the changes which the sediments have undergone, while the earthquakes of the present time show that land movements are still going on.

There is considerable resemblance between the geology of Japan and that of the western coast of America. In both California and Japan there is a similar basement complex. In both intrusions of granite, apparently of Mesozoic age, are widespread and important. The old floras and faunas show considerable resemblance, as do also those of recent times. Further, in both cases there have been long coastal belts of volcanic activity during Tertiary and Quaternary times, the thickness and wide extent attained by the Tertiary tuffs of Japan being remarkable. Both countries show recent earth-movements, as illustrated in raised Quaternary deposits and marine terraces, and in the present oscillations of the shore level. In both countries land-building was tremendously rapid in Tertiary times, when land areas were rapidly denuded and great thicknesses of rock deposited along narrow belts.

The Hydrography of the Sangpo.—In the *Annual Report* of the Board of Scientific Advice for India (1905-6) there is a note by Colonel Burrard calling attention to the peculiar fact that all the principal tributaries of the Sangpo show a tendency to flow in the opposite direction to the main stream. Colonel Burrard suggests as an explanation of this the hypothesis that at no very distant date the river flowed from east to west instead of from west to east, and that the tributaries were developed at this period. When the river reversed its course he supposes that a great lake was formed in south-eastern Tibet, which overflowed the southern ranges, and gradually cut a gorge through them. The same process is happening in Kashmir, where the Jhelum is cutting a gorge. Colonel Burrard also points out the curious fact that in the Himalayas the highest point of a range of mountains is frequently in close proximity to the gorge of a river. He thinks that the explanation may be that the highest points of a range tend to occur where the range bends, and that bends are at the same time the weakest points of a

range, the parts most easily attacked by water and ice. It will be of interest to learn whether the Sangpo also pierces the Himalaya near a point of maximum elevation, but this is not a point likely to be settled meantime.

AFRICA.

The Nyasaland Protectorate.—An Order of Council, dated July 6, was promulgated at the beginning of September, changing the designation of the British Central Africa Protectorate to the Nyasaland Protectorate, and appointing a governor in place of a commissioner and executive and legislative councils.

Plant-zones on Mt. Ruwenzori.—At a recent meeting of the Linnæan Society, a paper was read giving some account of the plants of Ruwenzori as studied by Dr. Wollaston in his expedition (cf. p. 380). From 3000 to 7000 feet the vegetation includes some common tropical weeds, with a fair percentage of more localised species and some novelties. Cultivation ceases above 7000 feet, and the largest forests occur between this height and 8000 feet. Above 8000 feet the forest thins out, and is gradually replaced by a belt of small tree-heaths and Podocarpus. On the east side the bamboo zone begins about 8500 feet, and extends up to 10,000 feet. The big tree-heaths begin about 9500 feet, at which height a number of terrestrial orchids were found, with numerous ferns. From 10,000 to 11,000 feet moss is abundant on the ground, and also on the trees, forming cushions two feet deep. In this region two tree-lobelias were found. Between 11,000 and 12,000 feet, helichrysums, lobelias, tree-heaths and tree-senecios are the conspicuous plants. The heaths cease about 12,500 feet, but the tree-senecios continue up to nearly 14,000 feet. Another kind of lobelia appears at about 12,500 feet, and continues almost to the snowline on the steepest slopes. The helichrysums sometimes form bushes four to five feet high, and grow luxuriantly. At 14,000 feet a small *Arabis* was found, and a rush, a grass (a new species of *Poa*), and mosses were found growing up to the level of permanent snow.

AMERICA.

French Guiana.—We have received a pamphlet entitled *Notice Historique sur La Guyane Française*, by M. Henry Richard, which was published on the occasion of the Colonial exposition at Marseilles last year. The author, who is Honorary President of the Chamber of Agriculture at Cayenne, in a prefatory note says that his object is not to give a complete account of the history of the Colony, but simply to draw attention to its resources and possibilities. The colony, he says, has been much neglected, and requires capital and energy for its further development. The historical account shows that at the end of the eighteenth century French Guiana contained a large number of cattle

and sheep, and that this industry had reached considerable dimensions. Neglect, disease, and other causes led to the disappearance of the model farms and to the great reduction in number of the cattle, so that now the colony requires to import much of its butcher meat. According to the author, however, the savannas which extend from Macouria to Organabo, at the border of the sea, are capable with proper care of once more supporting abundant flocks and herds. Similarly, various past attempts have shown that parts of the country are capable of producing all the tropical plants of commerce, cocoa and rubber being especially likely to be profitable. Again, the partially sandy ground of the littoral from Point Macouria to Organabo has in the past produced cotton and would do so at a profit now, when the demand for the product is so greatly increasing. The industries just mentioned require the improvement of the means of communication, and some attempt should also be made to open up the rich forests of the interior. The first desideratum in the author's opinion is the appointment of a permanent scientific commission, which should study in detail the resources and possibilities of the country.

The Sierra Maestra of Cuba.—An article by Mr. B. E. Fernow in the *Bulletin* of the American Geographical Society (May 1907) gives a brief account of a journey in the High Sierra Maestra of Cuba. Of special interest is the account of the forest of the region. The High Sierra Maestra has a general level of over 3000 feet, and though there are two rainy seasons, from March to May or June, and from September to November respectively, yet the climate is on the whole dry, the conditions varying between the xerophytic and the mesophytic types. The whole mountain range is densely clothed with forest, but owing to the relative dryness this is very much less dense than the typical tropical forest. The undergrowth is not excessive, and the woods are not gloomy and impenetrable, as in a damp tropical region. The author emphasises, however, a point of interest which differentiates this forest from a temperate one, which at first sight it somewhat resembles. This is the large number of species, and the relatively small number of each species present. Great numbers of individual trees do not occur, and there is nothing to represent the numerous pines, or maples, or oaks, or so on of the northern forests. In other words, the struggle for existence in so far as inanimate nature is concerned is less keen than in the temperate forest, and therefore no one species has a handicap as compared with its neighbours. Commercially this renders the tropical forest much more difficult of exploitation than the temperate one, for the valuable species occur in single specimens or small groups, and other specimens of the tree may not occur within a considerable radius. Another consequence of the equal terms on which the species compete is that trees of commercial size are few. Over the area examined by the author marketable trees rarely rise to ten per acre, and on the average there are less than two such per acre. The forest in which these observations were made is, it may be noted, virgin; much of it indeed has never been explored.

AUSTRALASIA.

Population of Commonwealth of Australia.—We have received from the Commonwealth Statistician a *bulletin* on the Determination of the Population of Australia for each quarter from December 31, 1900, to December 30, 1906, which also includes a review of Census Methods. From this pamphlet we extract the following figures in regard to the different States. The total estimated population of the Commonwealth on December 31, 1906, was 4,085,417 persons, of which 2,153,119 were males, and 1,982,298 were females, and this population was distributed among the States as follows:—New South Wales, 1,526,607; Victoria, 1,231,940; Queensland, 535,113; South Australia (including Northern Territory), 383,829; Western Australia, 261,746; Tasmania, 180,156.

POLAR.

The Anglo-American Polar Expedition.—According to a telegram from Winnipeg at the beginning of September, the *Duchess of Bedford*, the vessel of this expedition, was lost near Fort Anxious at some prior period. Captain Mikkelsen, Mr. Leffingwell, and another member of the party had left the ship in February, with sixty days' provisions, in search of supposed land to the north, and at the time of the vessel's loss they had been gone seventy days, and no news had been received of them, though one of their dog teams had returned.

Up to last December the expedition, it is known, was stationed at the ship's winter quarters, off Flaxman Island (cf. also p. 318), whence Captain Mikkelsen intended to start on his expedition to the north. According to a June telegram, Captain Mikkelsen reached Herschel Island in April of the present year, and reported that the ship was ice-bound 150 miles to the north-west. He started to return to the vessel at the end of April with the intention of navigating further north, but it would appear probable that at this time the vessel was already lost. The information which has since been received, though sufficient to relieve the anxiety which was beginning to be felt as to the safety of the members of the expedition, is not yet adequate to make quite clear the movements of the two parties. At the time when news was received of the loss of the vessel it was known that the party on board was safe, but, as stated above, nothing was known as to the whereabouts of Captain Mikkelsen and Mr. Leffingwell. On September 9, however, a message was received from Mr. Stefansson, the ethnologist of the expedition, dated from Eagle City, Alaska, which is on the Upper Yukon river, stating that the expedition was safe. This was followed a few days later by a more detailed message from Captain Mikkelsen and Mr. Leffingwell. The message was dated from Dawson City, in the Yukon territory, and stated that the party had sledged 500 miles over the sea-ice, crossing the continental shelf twice. Soundings had been taken fifty miles off the Alaskan coast and beyond, but no bottom was found at 630 metres. Next year the party hope to continue their exploration of the geology and ethnography of the district, together with the survey of the Beaufort Sea.

Mr. Harrison's Arctic Expedition.—In vol. xxii. p. 604 we published a short note on Mr. Harrison's Arctic expedition (see also xxi. p. 609), which started with the object of investigating the same problem as Captain Mikkelsen. In the middle of September of the present year some further news came to hand of Mr. Harrison's movements. Though he has not succeeded in carrying out his original scheme he appears to have done much useful work in the region of the Mackenzie river. The letter referred to brought the account of Mr. Harrison's movements down to the middle of June, and was dated from Fort Macpherson, Peel river, to the west of the Mackenzie river. During the period from September 1906 to last June Mr. Harrison was occupied with survey work in the region of the Mackenzie, especially to the east of this river. Last autumn he visited the Eskimo lakes near the coast to the east of the Mackenzie, and as game was very scarce and fish plentiful in the lakes he wintered near them. The fish lasted well into January, but so soon as the sun reappeared no more were caught, either on hooks or by nets. In January Mr. Harrison went down to the coast, and surveyed the coastal region. As a result he has made maps both of the east and west branches of the Mackenzie from Fort Separation to the ocean, and also from the east branch of the Mackenzie to $130^{\circ} 59' 22''$ W. long. and up to $68^{\circ} 40'$ N. lat. from the coast. Mr. Harrison has been considerably hampered in his movements by a scarcity of supplies.

The Wellman Polar Expedition.—The members of this expedition arrived at Tromsø in the middle of September, the attempt on the Pole having been abandoned on account of the unfavourable weather. An attempt was made to launch the airship at the beginning of September, but the wind drove it back to the mainland of Spitsbergen. The season during the present year has been throughout unfavourable.

GENERAL.

The Ninth International Geographical Congress.—In our February issue (p. 101) a preliminary notice was given in regard to this Congress. According to a long article in *Le Globe* (June 1907), at a meeting of the Organising Committee held in May of the present year, the arrangements for the Congress were further elaborated, especially in regard to the scientific excursions. These number ten, vary in length up to eight or ten days, will take place some before and some after the Congress, and are each to be under the charge of a specialist. It is expected that in the course of these varied excursions all the important questions in regard to scientific geography will receive consideration. From the preliminary programme of the excursions, which appears in the same article, we extract the following. Dr. J. Früh will lead an excursion, lasting six days, to study the morphology of the Alps and their foothills. This excursion starts from Zürich, and the party will cross the Brünig to Meiringen, descend to Interlaken, cross the Gemmi, and follow the Rhone valley to the lake, and so to Geneva. A longer and more elaborate excursion, under Dr. Lugeon, will have for its object the study

of the phenomenon of inverted folding in the Alps. Starting from Lausanne, this party will study part of the shores of Lake Geneva, the district of Leysin and the Ormonds, the structure of the Dent de Morcles and the Diablerets, the gorge of the Rhone, and will then ascend to Zermatt, from which place the return to Geneva will be made. M Muret will lead an excursion for the study of economic forestry in the High Alps, which will last a week, and will start from Brienz. The ground covered may be indicated by the following list of sleeping-places—Brienz, Neuchatel, Fribourg, Aigle, Villeneuve, Bex, Geneva. Under the leadership of Dr. Schardt the structure of the Jura, the plateau, and the Alps will be studied in two excursions, one before and one after the Congress, occupying a total of ten days. The first will start from Neuchatel, and will follow the route Bulle, Grandvillard, Rougemont, Gstad, Gsteig, Sanetsch, Sion. The second part will be devoted to the southern part of the crystalline Alps, and starting from Brigue the party will cross to Domo d'Ossola by the Simplon. From Domo d'Ossola they will travel to Varzo and Veglia, and so by the Passo Forchetta to Brigue again. An elaborate botanical excursion, under the leadership of Dr. Schroeter, and lasting eleven days, will start from Lucerne, where Pilatus will be ascended, then the party will travel on to the Engadine, and to Lakes Como, Lugano, and Maggiore, the return to Geneva being made by the Simplon route. There will be also a series of shorter excursions, one to study vegetation contrasts and the technique of botanical distribution in the vicinity of Lake Geneva under the leadership of Dr. Briquet, and one to study Chemical Erosion, under Dr. Emile Chaix. Glacial morphology will be studied under Professor Brückner in an excursion which starts from Geneva, and includes Chamonix, the Rhone Glacier, and Lucerne. Professor Brunhes will lead a party for the study of the contrasts between glacial and fluvial erosion in an eight-day excursion, chiefly in the Bernese Oberland region. All the excursions are limited as regards numbers, and detailed instructions are given as to the necessary equipment, amount of walking, etc., as well as the estimated cost of each excursion.

COMMERCIAL GEOGRAPHY.

The Economic Development of Japan.—Attention may be drawn to a lengthy article, illustrated by a map, in the *Bulletin Economique* (January to February, 1907), in which M. George Dauphinot gives a detailed account of the resources and commercial development of Japan. The article is not of a nature which lends itself readily to the purposes of an abstract, but it may be recommended to the notice of those specially interested in the subject. Of special value is the account of the rapid industrial development of the country. An important factor has been, and still is, the low rate of wages, and the large amount of female labour available, at wages of from 36 to 62 centimes per day (*i.e.* about 3½d. to 6d.) Female labour is utilised in almost all forms of industry. The development of industry has also been aided by the large amount of water-power available. The author takes a favourable

view of the condition of Japanese finance, but considers that in view of the rapidly developing industries the existing policy of protection will require modification.

EDUCATIONAL.

In the *Geographische Zeitschrift* for July 30, Professor Geistbeck publishes a paper on "Methods of Geographical Teaching," which was prepared for a discussion on this subject at the 16th Deutschen Geographentag at Nürnberg. If it contains nothing strikingly novel, the paper emphasises once more points in connection with geographical teaching which are worth constant repetition. Some, perhaps, of the suggestions are rather counsels of perfection under the ordinary conditions of school teaching, but as ideals they may be found stimulating.

In the first place, Professor Geistbeck considers that geography must be definitely regarded as a subject which can only be studied by the method of direct observation. Who will learn to know the earth as it actually appears must, as he picturesquely says, come forth from the four walls of the school. It is not there that the subject can be studied, and just as the study of botany must begin with the living plant (let teachers of nature-study note this!), so the study of geography must begin with the world as it is. The elementary geographical conceptions, the general points in regard to earth-knowledge so far as these are illustrated in the home district, methods of orientation, of measurement, the rocks underlying the surface, the plants and animals of the home district, and so forth, no less than an elementary knowledge of map-reading—all this should be learnt in the field. Further, it is essential, says Professor Geistbeck, that the method of direct observation should be continued throughout the whole school course and not confined to one period. In the early stages the object should be only to develop the "geographic sense," and to arouse geographical interest, while later the scholars should be more and more trained in the practical handling of maps, no less than in the perception of the relations of geographic phenomena. The author lays great stress upon the value of training in the comprehension of a landscape through the eye, because of the frequency of repetition of the same type of landscape in different parts of the world. Thus when the scholars have been trained to perceive the morphological features due to recent severe glaciation in their own district, they know also the prevalent type of landscape in a great number of other areas. In the field work the simpler forms of scientific instruments should be employed, and care should be taken to prevent the lessons becoming too vague and generalised by assigning a definite object to each.

This direct observation must, however, be supplemented by indirect forms of observation in the schoolroom. Here reliefs of the home district, photographs, and especially maps, are of supreme importance. They must be supplemented by various collections, as of stones, minerals, specimens of commercial products, and so on. An interesting suggestion

is the construction of a geological map of the home district, with the actual rocks of the locality.

As regards what he calls the anthropological element in earth-knowledge, Professor Geistbeck is strongly opposed to the division of the subject into the two branches of political and physical geography, studied separately. The rivers, lakes and seas, the hills and valleys, the plains and mountains, wind and weather, appear as acting forces in the life of the people of the region, and the true value of geography is lost unless the intimate relation of the physical environment and the economic facts is made clear by simultaneous study. Geography, as the author truly says, is not a mere combination of sciences; these form the elements of which it is composed, but they combine to constitute a new science, as chemical elements unite to form a compound. The ruling idea of geography is the organic relation between the earth and its living creatures: it is a synthesis, and all facts which cannot be related to other facts should be excluded from its sphere and left to the separate sciences to which they properly belong, while on the other hand facts which can be correlated should be studied in their relations.

NEW BOOKS.

EUROPE.

The Land in the Mountains: Tyrol. By W. A. BAILLIE-GROHMAN. With Introduction by CHARLES LANDIS. Illustrated with 82 Plates and Maps of Modern Tyrol and Ancient Rhaetia. London: Simpkin, Marshall and Co., Ltd., 1907. Price 12s. 6d. net.

The name of Mr. Baillie-Grohman is well known on both sides of the Atlantic and in various fields of activity. But, possibly, in all his writings he has found no field more congenial to him than this description of Tyrol, his native land. The story of Tyrol ("The Tyrol" is incorrect) is told from all points of view, and much and well-directed study has gone to the telling of it. Thanks largely to its possessing in its centre the Brenner Pass, "the natural portal between the North and the South," history has seldom stood still in Tyrol; rather it has been a continual epitome of the history of Europe. The tale is vividly told here, and many are the interesting personages figured—the Emperor Maximilian, whose love of sport is done justice to; George Von Frundsberg, the creator of the first drilled-mercenaries in Europe; the great Fugger family, the Rothschilds of the Middle Ages; Archduchess Eleanore, daughter of James I. of Scotland, who so drew to herself the affections of her subjects; and many others. The accounts given of the people of Tyrol, past and present, of the country itself and its castles with their treasures of ancient armour and furniture, make the reader glad that it has fallen to one so admirably equipped for the task to give to the English-speaking world this first authoritative description of a singular country.

There is no page in the volume without interest. But the immediate attraction is the wealth of beautiful illustrations with which it is enriched—picturesque ruins, antique drawings, details of wood-carving, mountain scenery, etc.—and through all are scattered many views of the author's own Schloss Matzen in the Unter Inntal, which forms a worthy example of the Tyrolean castle as it

remains to-day. We may note also the fly-leaves facing the plates, which, besides the name and a description of the plate, give references to the text and to other plates,—a useful feature.

An interesting biography of Mr. Baillie-Grohman, from the pen of an American friend, opens the volume.

Red Russia. By JOHN FOSTER FRASER. London, Paris, New York, and Melbourne: Cassell and Co., 1907. *Price 6s.*

A very lurid picture, and not nice reading! We find no fault with the author, he conceives he has a duty to perform, and he has done it very well, but we would fain, after reading his book, prefer to think that he has painted the picture too red.

The book is a kaleidoscopic review of Russia as she is to-day, and according to Mr. John Foster Fraser she is in a very bad way indeed. Serfdom were freedom compared to the grinding tyranny of Bureaucracy and Militarism. The country is seething with sedition and secret societies from the Baltic to the Pacific. The Duma is a hollow mockery. Government there is none. The nation is bankrupt materially and morally, and if one half only of what Mr. Fraser tells us were true, Russia is not fit to rank as a civilised country as we understand civilisation in the twentieth century. We are in accord with Mr. Fraser when he says, "What Russia wants is a strong man." At present she is a festering sore among nations. We repeat, the book is not nice reading, but it is worth reading, nevertheless.

Companions in the Sierra. By CHARLES RUDY. London: John Lane, 1907. *Price 6s.*

This is a purposeless little book, written in a poetic vein, with very pretty descriptive vignettes of Spanish country scenery, men and donkeys, and a very characteristic prefatory introduction by Mr. R. B. Cunningham Graham.

Field Path Rambles. By WALKER MILES. Series 29: over one hundred miles of rambles round Leith Hill, with a route from Dorking to Horsham and back. With Illustrations. London: Taylor and Son, 1907. *Price 1s. net.*

This is a member of a useful little series of books whose object is to encourage country rambles, and facilitate their accomplishment. Though the particular locality is outside our range, yet the object is one which a geographical society should encourage by every means in its power. We are, however, somewhat scandalised to read in the accompanying advertisement slip that the routes are so fully detailed "that all necessity for consulting a map is avoided." A Rambler who does not always carry a map has yet to learn the A B C of his sport, and to suppose that any book or guide can replace a map is to ignore the fundamental postulates of the geographer.

ASIA.

Japanese Rule in Formosa. By YOSABURO TAKEKOSHI. Translated by GEORGE BRAITHWAITE. London: Longmans, Green and Co., 1907. *Price 10s. 6d. net.*

A very impartial account by a Japanese of Japanese colonisation. The author does not unduly magnify the achievements of his countrymen nor minimise their failures, for the Japs, like their predecessors the Dutch and Chinese, have had their failures in Formosa. This is not a book like Consul Davidson's comprehensive volume upon this enchanting island, but it is a book well worth reading

as an object lesson to all nations, more especially Germany, as to "thorough" when applied to colonisation.

The Japanese have had to begin all over again with their treatment of the savage native tribes, and have now got them well in hand. The possibilities of this—perhaps the most fertile and productive island in the world—are very interestingly dealt with, and the rapid development of the resources of the agricultural and mineral wealth of the country in so short a time is nothing short of marvellous. Altogether, this is a very educative and readable volume, and the translator has done his work well.

To-morrow in the East. By DOUGLAS STORY. London: Chapman and Hall, 1907. Price 6s.

This book is a somewhat disconcerting contribution to the elucidation of the future in the Far East, by one who can claim more than the average newspaper correspondent's knowledge of the subject. The author takes rather a pessimistic view of the future as regards British interests in the Orient, and sees no material advantage to us in our alliance with Japan. His version of the history of the Japanese protectorate over Korea may be true or not, but it shows at any rate that the Japs have not much to learn from Western methods when diplomacy fails. The book begins with a chapter on "The New Egypt," written in the same alarmist strain which permeates the whole volume, and we think the picture is overdrawn. The book, however, deserves some attention.

Sunny Singapore. By Rev. J. A. BETHUNE COOK. London: Elliot Stock, 1907. Price 5s. net.

One of the numerous books dealing with missionary effort in the East, of which we should say the supply is quite equal to the demand. Himself a missionary, the author has presented a modest review of missionary work in Malaya. He has marshalled his historical facts very succinctly, and the accounts of the Chinese population in Singapore and the Federated States, as also the chapter on the future of China, are thoughtfully written.

The Imperial Gazetteer of India. New edition, published under the authority of His Majesty's Secretary of State for India in Council. Oxford: at the Clarendon Press, 1907. Price 6s. net for each of 26 vols., including the *Atlas*, or £5 (4s. each) subscription in advance.

From every point of view, save the literary, this third edition of the India Gazetteer promises to prove the greatest book ever published on our Indian Empire. It is more, it is a far more adequate and complete scientific and administrative treasury of fact and philosophy regarding the land and the people, and especially the geography, than any civilised Government in Europe or America has yet attempted to prepare. This colossal enterprise has cost the Indian Government from first to last £75,000. The late Sir W. Hunter had practically *carte blanche* to organise all over India the material, which in 1881 appeared in nine volumes. Since that time not only has the book passed out of print, but the Indian Empire has grown, the census of 1901 has revealed much, and, above all, a whole crowd of experts have risen from the Civil Service chiefly skilled to bring to the new facts the latest teaching of science and of administrative experience. Hence the twenty-six volumes will form a new book worthy of the subject.

The first four volumes, each of more than 500 demy octavo pages, are devoted

to the description of, and historical, economic and administrative, accounts of India. These will be followed by the Atlas of sixty-four plates and the alphabetical gazetteer made up of articles re-written by the district officers and the superintendents of the census of 1901. Only the descriptive, economic and administrative volumes are now before us. These at once establish a high standard of excellence. For each chapter the ablest expert has been secured. Not one of the articles falls short of excellence and fullness combined, save, perhaps, that on the many religions professed in India. The same justice is not done to Christianity as to Hindooism and Animism.

The writer, evidently in defective sympathy with the one Faith which claims universal allegiance, contents himself with a reference to the satisfactory chapter on the subject in the second edition. Very admirable is Dr. Grierson's chapter on the Languages. Other writers are Sir Joseph Hooker on the Flora, the late Dr. T. W. Blandford on the Fauna, Sir T. Holdich on the Physical Geography, Mr. Holland, F.R.S., on the Geology and Mineral Products, Dr. James Burgess on the Architecture, and Sir George Watt on the Arts and Manufactures. Most clear and satisfactory are the chapters on the land revenue and tenures, on rents, wages and prices, and on agriculture. To Sir Herbert Risley, the editor, is due the original outline of this magnificent undertaking, to which we hope to do justice as the successive volumes appear.

AMERICA.

On the Mexican Highlands. By WILLIAM SEYMOUR EDWARDS. Cincinnati : Jennings and Graham, 1906. Price \$1.50 net.

This is a pleasantly written account by a passing visitor of a six weeks' trip through New Orleans, Central Mexico, and home to the United States *via* Cuba. The writer describes, with the help of a kodak, his impressions of the places he saw, and his pictures of Mexico, if slight, will prove interesting so far as they go, especially to American readers, for whom they are primarily intended.

The author paid a visit to the copper mines on the Balsas River in the *Tierra Caliente*, or hot country, about which he gives sundry interesting notes, describing the unhappy lot of the enslaved Indian peons who wear out their miserable lives to enrich their luxurious owners in Mexico City, Madrid, or Paris, as their ancestors have done before them for hundreds of years. At page 145 we read of one of those mines : "The Mina el Puerto is an ancient mine, now nearly exhausted ; for it has been worked almost two hundred years, all through a single doorway cut into the rock, barred by a great wooden door, fastened by a ponderous lock with a ponderous iron key. Each morning for many decades the owner has taken the key from his belt, unlocked the big door, and sent fifteen to twenty naked Indians down the 'chicken ladders' (poles with notches cut in them for steps) four hundred feet into the hot mines below. There is no ventilation, there are no pumps, there is no other way to go in or out. Two or three hours is the longest time a man can work at the bottom of this hole ; when the Indian can stand it no longer he climbs up bringing on his back the ore which he has been able to dislodge, or a bag of water, if any shall have leaked in." The first owners of the mine had taken up only half an acre, and nobody had ever entered the mine to ascertain its size, except the owner himself, who kept the big key on his belt, while generations of Indians dug and sweated in the unknown depths inside. This might have gone on to the present day but for an accident which happened two or three years ago. One stormy night two American travellers chanced to take refuge under the hospitable roof of the wealthy Mexican owner, who in his

courteous Spanish style gave them the best of his fare and the biggest of his hammocks to sleep in. "All that he had was theirs," including the history of his family mine of wealth. They were sent off with every token of goodwill next day. A few months afterwards, however, they returned with a mining inspector from the Mexican government and a company of rurales or mounted police with arms. The owner to save taxes had never acquired a title to anything beyond the original half acre, and if ore had been extracted from the ground outside it, it had been stolen from the government, and dire are the penalties for theft in the land of the iron hand. What lay beyond the half acre now belonged to the two strangers, who had acquired a title since their visit, and might sue in the courts and recover full value of it and all legal costs if they thought proper. They politely explained the circumstances to their former host, and intimated to him that they would not prosecute, provided he made a deed in their favour for all the claim he had to the half acre, including the big door and anything else he might possess. He was a discreet man, and the rurales had repeating rifles of the latest pattern in their hands. He then mounted his horse, which the strangers allowed him to keep, and rode away a beggar. Next morning the Americans unlocked the big door and sent the Indians down to their daily toil; but the author explains (page 150) that these gentlemen had had to beat a hasty retreat from their own country a short time previously, and at the time of his visit one of them was in a Mexican prison for robbing his partner, and the latter had disappeared after committing another offence, leaving the mine in the hands of receivers!

Such incidents as these are not calculated to allay the suspicions of Mexicans about their northern neighbours, and one cannot wonder at the underlying feeling of dislike with which the "gringos" are everywhere regarded in Mexican mining districts.

Through Jamaica with a Kodak. By ALFRED LEADER. Bristol: John Wright and Co., 1907. Price 6s. net.

In this daintily got-up little volume the writer gives a pleasantly-written and simple account of a tour in Jamaica, which occupied some four or five months of the year 1905. There is no effort at fine writing or at the compilation of a guide-book. The writer merely gives his impressions of what he saw as he passed from place to place in the island. The principal attraction of the volume is the many illustrations, nearly all of which are photographs taken by Mr. Leader himself. In an introductory note the Archbishop of the West Indies vouches for the truthfulness and discretion of the author, and states that "this volume will prove very acceptable to those who desire to get, within moderate compass, a correct impression of the island and its people. The writer has furnished on the whole a remarkably accurate representation of both. The photographs have been chosen with discretion, and are really illustrations of the normal condition of the country and its inhabitants."

Forty Years in the Argentine Republic. By ARTHUR E. SHAW. London: Elkin Brothers, 1907. Price 2s. 6d. net.

The author of this little volume has spent forty years in Argentina mostly in employment of one or other of the many railways which have been constructed in that republic. His reminiscences are set forth in a series of gossipy, slangy sketches, from which the reader may glean some amusement and may gather some information as to the development of Argentina since 1864. The numerous anecdotes are characteristic of the Southern Hemisphere, and support the some-

what disparaging view the writer takes of public life and morality in the Argentine.

AUSTRALASIA.

The Real Australia. By ALFRED BUCHANAN. London: T. Fisher Unwin, 1907. Price 6s.

The aim of this book is not geographical. It is to picture the life—the social, literary, individual, present-day life of the developing Continent with its four millions of people. What lends interest and value to the book is that the author is a resident Australian. He possesses a vivid and attractive style, not without the cynical touches to which all picturing of life easily lends itself, but writes with evident sincerity and good-will for his adopted country. He holds up the mirror to the various phases of life, principally as centred in Melbourne and Sydney, two cities whose characteristics the author contrasts and describes in brilliant fashion. The first glimpse of Real Australia he presents us with is that of its "Virtues and Vices." Its principal virtue is hospitality, and its glaring vice is gambling. Horse-racing is its chief sport, the national recreation. And as the author remarks, "the two—racing and gambling—insensibly melt into each other." Society is controlled by women, and dominated by snobbery. The ideal that overtops all others is purely a monetary one. In the game of politics all classes can participate, and the game is played with not too clean hands. Sketches are given of the four leading statesmen—Sir Edmund Barton, Mr. Alfred Deakin, Mr. Chris. Watson, and Mr. George H. Reid. In the literary sphere Australia still struggles with the common fate of small communities, of despising its own products. London is the objective of the literary genius. Unless the message of the poet, or the novelist, or the essayist has been wafted to and fro across the distant seas, the Australian public passes it by unheeded. Yet the examples that Mr. Buchanan gives of the talent of the young Continent show that the foundations of an Australian literature are being nobly laid. It is the universal misfortune of those who lay the foundations to be, at the beginning, among the despised and rejected of men. The Imperialist and the Little Australian are depicted in strong colours in the concluding chapters of the book. The religious side of Australian life, which one would have thought would have a place in *Real Australia*, the author is evidently unacquainted with.

GENERAL.

Eiszeit und Urgeschichte des Menschen. Von J. POHLIG. Leipzig: Quelle and Meyer, 1907. M. 1'25.

In this little work Professor Pohlrig gives an outline sketch of the Glacial Period, and passes in review the opinions held by anthropologists and geologists as to the several races of man whose remains and relics have been met with in Quaternary or Pleistocene deposits. The author strongly supports the view, now so widely held, that the Quaternary was distinguished by its peculiar climatic conditions—cold or glacial and warm epochs alternating throughout the period. The apelike man (*Pithecanthropus*) discovered by Dubois in Java is assigned by Dr. Pohlrig to "older Quaternary times." "Neandertal Man," for a long time represented by one cranium only, has within recent years acquired greater importance. The remains of some three hundred men of the same type have been discovered in a cave near Krapina in Croatia, so that there cannot now be any doubt that a race of men with "brutal skulls" lived in Europe during the Quaternary Period. According to our author the Neandertal race flourished in the second or "Helvetian" interglacial epoch, and seems to have emigrated when

the next succeeding or third glacial epoch was approaching. Next after this race appeared a type represented by certain skulls discovered at Brünn in Moravia, which Pöhlig designates the "Neandertaloid." To a still later date belong the better-formed skulls met with in the caves of France and Belgium (Cro-Magnon and Engis). The author has succeeded in crowding into his book much interesting matter, which is so well arranged, however, that the reader will have little difficulty in following him. But he need not be surprised if not a few of his statements and conclusions should be contested by others who are labouring in the same field of work.

The Oxford Geographies. Vol. III. The Senior Geography. By Dr. A. J. HERBERTSON and F. H. HERBERTSON. Oxford: Clarendon Press, 1907. Price 2s. 6d.

This admirable little text-book, following the first and second volumes which are intended for junior pupils, is meant to carry the teaching up to the point where university work may profitably start.

The world is described according to its natural regions, which are classified into the following four groups:—(1) Polar; (2) Cool Temperate; (3) Warm Temperate; (4) Hot Lands. Each of these, with the exception of (1), is subdivided into four sections, and these again into lesser natural divisions. The treatment is both physical and historical, and well calculated to attract the pupil and make him delight in studying geography when put before him in such a pleasing style. These books are now too well known to require more commendation to teachers in elementary and higher schools.

Lehrbuch der Ewe-Sprache in Togo (Anglo-dialekt), Mit Übungstücken, einem systematischen Vokabular und einem Lesebuch. Von A. SEIDEL. Heidelberg, Paris, London, Rome, St. Petersburg: Julius Groos, 1907.

Die Haussasprache: Grammatik (deutsch) und systematisch geordnetes Wörterbuch. Haussa-deutsch-französisch-englisch. Von A. SEIDEL. Heidelberg, Paris, London, Rome, St. Petersburg: Julius Groos, 1907.

Both of these books are written according to the Gaspey-Otto-Sauer method. The second is written in German, French, and English, the first in German only. Both are remarkably full and detailed, and should be of great use to the students of the languages concerned.

Red Rubber: The Rubber Slave Trade on the Congo. By G. D. MOREL. With an Introduction by Sir HARRY H. JOHNSTON. London: T. Fisher Unwin. Popular Edition. Price 1s. net.

This book is devoted to a subject with which as a geographical society we are not concerned, though as individuals every one of our members may be directly interested. We can therefore do no more than call attention here to our receipt of the volume.

Voyages of the Elizabethan Seamen: Select Narratives from the "Principal Navigations" of Hakluyt. Edited by EDWARD JOHN PAYNE. Oxford: At the Clarendon Press, 1907. Price 4s. 6d. net.

In an editorial note to this most interesting volume Mr. Payne explains that it is merely a condensation of the second edition of the two volumes of "Narratives" which were published some years ago. The condensation has been effected by the elimination of about 160 pages containing Sir Walter Raleigh's "dreary and philomythic" "Discovery of Guinea," and Cavendish's "Last Voyage," with the appendix giving his doleful letter to his friend and executor, Sir Tristram Gorges. The introduction to this volume, which is in many respects the

most interesting and instructive part of the work, is a reprint of parts of the introductions to the two volumes published in 1893 and 1900. By way of new matter we have a reproduction of a map of North America and Greenland, published by Hakluyt in 1599, and some valuable notes in elucidation of the text from the pen of Mr. Raymond Beazley, the distinguished author of the *Dawn of Geography*. The third edition of the *Voyages of the Elizabethan Seamen* deserves to be even more popular than its predecessors, alike with the younger and the older generations, and on both sides of the Atlantic.

A Grammar of the Bemba Language as spoken in North-east Rhodesia. By the Rev. Father SHOEFFER. Edited by J. H. WEST SHEANE, and arranged with Preface by A. C. MADAN. Oxford: Clarendon Press, 1907.

The Bemba or Wemba language is spoken throughout the stretch of country bounded to the north and west by Lakes Tanganyika and Bangweolo, on the east by the Chambeshi, and on the west by the Luapula and Lake Mweru. But it is understood from the Lualaba in the Congo Free State without a break to Karonga on Lake Nyasa, and this small grammar should therefore prove useful, especially as it is only the second work on the language which has been written. The Bemba language belongs to the Bantu group, and is remarkable for its multiplicity of grammatical forms, especially in regard to the verb and its tenses.

Tin Deposits of the World, with a Chapter on Tin Smelting. By SYDNEY FAWNS, F.G.S. Second Edition. London: The Mining Journal, 1907. Pp. 304. Price 15s. net.

After stating that "during the seventeenth and eighteenth centuries Cornwall seems to have been the main source of the world's tin supply," the author divides the deposits in which Tin occurs in economic form into (a) Fissure Deposits, Lodes; (b) Masses, Stockworks, etc.; and (c) Alluvial Tin Ore Deposits. He then describes the Alluvial Tin Deposits of the Malay Peninsula, Sumatra, Siam, Burma, and Indo-China with a chapter on Alluvial Tin Mining. He next describes the Lode Deposits in the Malay Peninsula, and then the Tin Deposits of New South Wales, Queensland, Tasmania, Western and South Australia, New Zealand, and Victoria. Next he discusses those of Bolivia, Cornwall, Nigeria, Transvaal, Swaziland, Congo Free State, Japan, Greenland, Finland, China, Korea, and Siberia, followed by those of Central Europe, Spain and Portugal, France and Italy, Scotland and Ireland, Mexico, the United States and Alaska. Descriptions follow of the Tin Mines of Mount Bischoff (Tasmania) and Dolcoath (the largest tin producer in Cornwall) with Chapters on Tin Crushing and Dressing Machinery, Dredging for Tin, Methods of Tin Assaying, Statistics of Tin Production and Tin Smelting, with a Bibliography.

In the Statistical Chapter are stated the "United Kingdom Imports of Tin Ores, 1906," amounting in all to 20,714 tons, whereof 17,627 came from Bolivia. The volume is exceedingly practical and exhaustive and is fully illustrated with views and sections of Tin workings and with Maps showing the various Tin districts of the world.

BOOKS RECEIVED.

We have received the following new books, which will be reviewed in due course:—

Cordova: A City of the Moors. By ALBERT F. CALVERT and WALTER M. GALLICHAN. With 160 illustrations. Crown 8vo. Pp. xvi + 159. Price 3s. 6d. net. London: John Lane, 1907.

Modern Argentina: The El Dorado of To-day, with Notes on Uruguay and Chile. By W. H. KOEBEL. With 123 illustrations. Demy 8vo. Pp. xv+380. Price 12s. 6d. net. London: Francis Griffiths, 1907.

The Guanches of Tenerife: The Holy Image of Our Lady of Candelaria and the Spanish Conquest and Settlement. By the FRIAR ALONSO DE ESPINOSA of the Order of Preachers. Translated and edited, with Notes and an Introduction, by Sir CLEMENTS MARKHAM, K.C.B. (Hakluyt Series.) Demy 8vo. Pp. xxvi+220. London: Hakluyt Society, 1907.

Island in Vergangenheit und Gegenwart. Von PAUL HERMANN. Zwei Bände. Vol. I., pp. xii+376; vol. II., pp. 316. M. 8'75. Leipzig: Verlag von Wilhelm Engelmann, 1907.

Paris and Environs with Routes from London to Paris. Handbook for Travellers. By KARL BAEDEKER. With 14 maps and 38 plans. Price 6 Marks. Leipzig: Karl Baedeker, 1907.

The Russian Peasant. By HOWARD P. KENNARD, M.D. Illustrated. Crown 8vo. Pp. 302. Price 6s. net. London: T. Werner Laurie, 1907.

Canada's Century: Progress and Resources of the Great Dominion. Notes with snapshots and other illustrations on an extensive tour in British North America. Royal 8vo. Pp. 552. Price 6s. net. London: *The Financier and Bullionist*, 1907.

The Long Labrador Trail. By DILLON WALLACE. Demy 8vo. Pp. xii+315. Price 7s. 6d. London: Hodder and Stoughton, 1907.

A Scientific Geography. Book IV., North America. By ELLIS W. HEATON, B.Sc., F.G.S. Crown 8vo. Pp. 130. Price 1s. 6d. net. London: Ralph Holland and Co., 1907.

Africa. Vol. I., North America. By A. H. KEANE, F.R.G.S. (Stanford's "Compendium of Geography and Travel"). New issue. Maps and illustrations. Second edition revised. Demy 8vo. Pp. xx+640. Price 15s. London: Edward Stanford, 1907.

Also the following Reports, etc.:-

Brown's Nautical Almanac for 1908. Pp. 867. Price 1s. James Brown and Son.

The Commercial Possibilities of West Africa. By VISCOUNT MOUNTMORRES. Pp. 24. Price 6d.

Liverpool University Institute of Commercial Research in the Tropics. Liverpool, 1907.

Report of the Progress of the Ordnance Survey to the 31st March 1907. London, 1907.

Punjab District Gazetteers. Vol. XIXB. Lahore District Statistical Tables with maps, 1904. Lahore, 1905.

The Surveys of British Africa. The Annual Report of the Colonial Survey Committee. London, 1907.

Notes on the Traditions of South African Races, especially of the Makalanga of Mashonaland. By R. N. HALL. Grahamstown, S.A., 1907.

Hydrographische Untersuchungen im Nördlichen Teile der Ostsee, im Bottischen und Finnischen Meerbusen. Helsingfors, 1907.

The River Pilcomayo from its Discharge into the River Paraguay to Parallel 22° S. With map of reference, detailed map in seven sheets, sketch of routes. By GUNNAR LANGE. Buenos Ayres, 1906.

British Rainfall, 1906. By HUGH ROBERT MILL. London, 1907.

Publishers forwarding books for review will greatly oblige by marking the price in clear figures, especially in the case of foreign books.

THE SCOTTISH GEOGRAPHICAL MAGAZINE.

THE NEW FIELDS OF GEOGRAPHY, ESPECIALLY COMMERCIAL GEOGRAPHY.¹

By Prof. Dr. MAX ECKERT (Aachen).

“NOTHING endures ; all is in a state of flux.” This saying of the ancient philosopher has even more validity now than in old times. That is proved in the progress alike of practical life and of science. Almost all fields of science are developing now more rapidly than of yore.

One rapidly developing discipline of recent years has been geography. It has attained a greater extent and come to embrace new fields of operation. Among those new fields that is the chief in which inquiry is made as to the relations between man and the land which he inhabits. This new field is called shortly anthropogeography, or the geography of mankind.

Friedrich Ratzel in the last decades of last century, but above all by means of his two-volume work entitled *Anthropogeographie*, was the first to create a scientific basis for the consideration of the conditions of man's dependence on the soil. But Ratzel was not the first to express anthropogeographical truths. Anthropogeographical observations are found in older researches, as in Montesquieu, Reinhold, Forster, Herder, Alex. v. Humboldt, Carl Ritter, and others. Carl Ritter expressly emphasised the dependence of man on the soil. For him the soil is man's dwelling-place and place of education. But he did not succeed in arriving at principles enabling us to take a comprehensive view of the distribution of man on the globe. Ratzel only has succeeded in founding anthropogeography as an independent branch of science, in fixing for that science the methods and subjects of inquiry. Amongst

¹ A paper read before Section E (Geography) at the Leicester Meeting of the British Association.

those who had the greatest influence on Ratzel, besides Herder and Ritter, may be mentioned Herbert Spencer, the great English philosopher.

Geography as a whole is an independent science, of which anthropogeography is an integral part. Although Löffler, professor of Geography at the University of Copenhagen, warns us against regarding anthropogeography as a special department of the science on the same footing as physical geography, nevertheless its tasks and methods, and the circle of ideas connected with it, are in many respects so different from those of physical geography that one is compelled to regard it in that light and to prosecute its development as such.

Anthropogeography is content neither with the mere empirical assortment of facts nor with the arrangement of those facts on the basis of external schematism without an explanatory foundation. It deals with a special field of facts and phenomena, and seeks to devise an elucidative connection between the separate geographical frameworks and the history that has been enacted and the civilisation that has been worked out within them. It has, therefore, all the qualities that go to constitute a discipline an independent science.

The objective sciences have for a long time been divided, in virtue of differences in appliances, methods, and principles, into the natural and moral sciences. The geography of man is the sole science in which the mutual relations between the natural and moral sciences are made manifest. Its dominant function has a side connected with the moral sciences in so far as it investigates the products of the mind with reference to the special region of intellectual life, and examines them in the light of their historical conditions; and on the other hand has a side connected with the physical sciences, in so far as it makes the physics of the globe the starting-point of its observations, and, with the aid of inductions in the sphere of natural science, arrives at general laws concerning the influence of the earth on man and that of man on the earth. It is manifestly the latter side that is the more important in anthropogeography.

As the question *Where?* is the first to arise in every geographical inquiry, so anthropogeography must start with the place nearest to that in which man lives, namely, with the settlement. The geography of settlements is an important foundation of anthropogeography. It treats of the situation, size, form, and development of settlements. The aspect of the settlement and its influence on the character of the landscape are further interesting questions. The study of the mode of establishment and of the local extent of the settlements leads to important results, which are first of an historical nature, in so far as they relate to the first settlers and the fluctuations of their history, and secondly of a sociological character, in so far as they relate to cultural institutions and the exchange of cultural ideas and plans.

In this investigation of settlements we must consider not merely the individual home but also the villages, towns, and cities of the whole habitable earth, of the "*Ecumene*."

Man desires not merely to dwell in a place, but also to live, that is,

to satisfy his wants. *Economic Geography* teaches us how man makes use of his place of settlement and his terrestrial environment to satisfy those wants. As economic interests extend and multiply man goes out from his narrow home, from his native sphere of activity; he has commercial intercourse with his neighbours, nay, even with other peoples. The discussion of the manner in which and the apparatus by means of which traffic is carried on leads to the *geography of traffic*.

Thus a modern and scientific geography of industry and commerce grows out of anthropogeography. Economic and commercial geography represent in a quite special manner the economic and physical sides of anthropogeography. On these views and the inquiries they suggest I have based my work entitled *Grundriss der Handelsgeographie*.

Chisholm, however, has attained similar results, but in a different manner. His excellent and celebrated book called a *Handbook of Commercial Geography* is the outcome of actual practice as much as a product that has sprouted on geographical soil. Anthropogeography was scarcely a starting-point for him. That for all that he has succeeded in building up a good work from an independent foundation arises, perhaps, to a great extent from the imposing and widely ramifying development of the economic and commercial life of the British people for many centuries. The history, the position in the world and the present commercial activity and commercial supremacy of Great Britain, gave directly an immense quantity of facts which do not come readily to an inquirer of another nationality.

Modern economic and commercial geography are really the same as what was formerly termed the geography of trade. The character and problems of modern commercial geography are shortly as follows:—

Commercial geography must have its source in the knowledge of situation and of orographical and hydrographical conditions, and, with the inclusion of important chapters on climatology, geology, political economy, and political geography, must arrive at a thorough understanding of the conditions of production and commerce both in separate regions and in the commercial world as a whole. More shortly stated, commercial geography must regard the earth as the seat of human production and commercial life.

Commercial geography presupposes the knowledge of "general geography," that is to say, the corresponding chapters of mathematical and physical geography. Commercial geography is not satisfied with knowing where the granaries of the separate countries and continents lie, but must ask for the reason, must inquire as to the situation in latitude and altitude, as to climate, water supply, and the composition of the soil. Thus commercial geography must take into account the fact that the growth of cultivated plants, whose value, as every one knows, is raised by increased demand, is quite different in mountainous situations, on low-lying ground, on marsh, moor, and alluvial soil.

The commercial geographer must, moreover, be familiar with the various degrees of decomposition of the different kinds of rock. Very important is the determination of the extent of löss over the whole area of the earth on which agriculture actually is or may be pursued. Thus,

in China, for example, agriculture is co-extensive with the deposits of löss, which, owing to its yielding nature, is perhaps a hindrance to traffic, but for the economy of the Chinese people is of very great significance. Some steppes have a soil distinguished by containing much humus in the upper, but possessing the character of löss in the deeper layers. The best known is the black soil, *chernozym*, in middle and southern Russia, on the Ob, and in the United States. A similar formation is the black soil, called *regur* or cotton-soil, covering a third part of southern India.

Besides the knowledge of the soil the knowledge of the orography or morphology of the earth's surface is important for commercial geography. The inclination of the ground to the horizon, and the relation of that angle to cultivation and insolation, have to be considered under the head of agriculture. The importance of these phenomena is most apparent in the case of the larger mountain chains. On the northern slopes winter is longer, and consequently the period of vegetation shorter; winter-sown crops do not succeed well, if at all, and in many cases the cultivation of some plants is altogether excluded. The southern slopes are often exposed to the process of freezing and thawing, so that winter-sown seeds are very apt to perish. In many parts of Switzerland and Scotland it has been observed that crops thrive better on the northern than on the southern side in spite of the ripening being six or eight days later.

The climate of a country is just as decisive as the soil concerning the to be or not to be of certain species of plants. George Chisholm rightly says: "In the case of cultivated products, soil and climate are considerations of first importance in determining the variety obtaining at different places." Every plant demands a certain minimum of warmth and moisture if it is to flourish. The polar limits of plants are determined chiefly by temperature; but the rainfall also is often an important factor in determining the distribution in latitude. If the weather conditions remained the same year after year, the same isotherms and isohyets would limit the distribution of species of plants. Experience, however, shows that the facts are quite otherwise. Existing observations show rather that neither the mean temperature nor the mean rainfall has so great an influence on plant growth as the variations of both phenomena. Thus, for example, the variations in the climate of Europe have important effects on the yield of the crops and the price of corn in our continent.

How far industry and commerce are dependent on climate I will not further explain.

Commercial geography is much enriched by anthropogeography in the inquiries respecting traffic. Anthropogeography enables us to understand the degree in which at different times and under different circumstances the means of communication have facilitated the movements of entire peoples, and have thus caused an acceleration of the course of history. The means of conveyance among civilised peoples are essentially different from those of primitive peoples. These know only the path, whereas civilised peoples have accelerated the movement both of goods and

persons by the construction of roads and by advances in the mechanical arts generally. These considerations lead to the knowledge of the fact that traffic and historical movements go on at the same time, or that the one prepares the way for the other, as for example, the business intercourse of Russian merchants with Siberia went in advance of the extension of Russian sway over northern Asia, and business relations between British merchants and the peoples of India and Africa preceded the acquisition of colonial possessions on the part of Great Britain in those regions.

Anthropogeography leads commercial geography to discussions about the relation of the zone of intercourse to the "Oecumene," the inhabited earth, about the quality of roads, the means of bridging over the gaps between different areas of human settlement, about roads as a standard of civilisation, as instruments of war, about traffic as a preliminary condition of the growth of states. All this is of the greatest importance in commercial geography, opens out quite new perspectives, and leads to a deeper comprehension of terrestrial problems.

Traffic is the movement or conveyance of persons, animals, or things towards definite points. According as one considers place, movement, or object moved, three large groups in the mode of intercourse can be distinguished. Considering place, I distinguish intercourse by footpath, mule (or other animal) track, road, railway, river, lake, coast, and over-sea traffic. Considering the nature of the movement one may distinguish walking, running, carrying, the employment of animals for riding or draught, and as beasts of burden, among which may be included flying animals as carrying pigeons, and the employment of sledges, ships, carriages, balloons, and wires with the aid of various mechanical contrivances and dynamical agents. Finally, considering the object moved one distinguishes traffic in persons, commodities, and news. In a general sense one also distinguishes intercourse by land, water, and air.

It is an important task of commercial geography to determine the regional distribution of the different kinds of road and the means of transport. The roads of commerce are not only a means of civilisation, they are also a measure of the degree of civilisation, and it is especially by the improvement in the means of transport that during the last hundred years commerce has attained a development both in content and extent with which that of antiquity can scarcely be compared, even when we consider the roads of the Romans and the Chinese and the cemented road of the Incas on the inner highlands of the Andes.

The highway of world commerce, so far as one may speak of it at all with reference to ancient times, has totally changed its character. Even to-day the roads of the interior of Brazil, of Africa, and of Asia (caravan routes) are nothing else than a certain kind of marked stages (itineraries).

The great pioneer in road (including railroad) making has been Great Britain, but the importance of commercial roads is now well appreciated and exactly known by other states, amongst which we may single out Russia. It is only by the abundance of the means of communication that that colossal and clumsy giant, chained at hands and feet, has become free and flexible. And it is just this fact which gives

us a sufficient explanation of the almost feverish haste in the construction of railways in eastern Siberia and towards the frontiers of Persia and Afghanistan.

Strictly speaking, a world-trade did not exist till the most recent times, till the Pacific became a link in the world's commercial highways.

The network of commerce has often been compared with the vessels that serve for the circulation of the blood in the human body. Just as this is effected by a number of larger and smaller veins and arteries that ramify through the body, so the world-trade is carried on in main-lines and by-roads the density of which depends on the direction and slope of the mountains, on the course of the rivers, on the climate, and on the fertility of the soil caused by the latter and by the general situation, on the natural products, and on the character of the confines both political and natural. In order to estimate the density of traffic in a certain territory it is less important to know the total length of the arteries of commerce than the ratio of that length to the area. It is even of greater interest to calculate the ratio of that length to a given number of inhabitants, say 10,000.

The methods of overcoming the obstacles to intercourse have been very much improved technically, but even in this connection there are still many points of view of geographical importance to be considered. A fine example of this kind of inquiry was furnished by R. M. Brown in his paper on "Climatic Factors in Railway Construction and Operation" in the *Scottish Geographical Magazine*, vol. xix. (1903).

The length of track interests the commercial geographer in virtue of the practical commercial importance of this factor in determining, along with others, whether the transport of goods will bear the freight charges or not.

The straits connecting great oceans and the great routes across continents are of peculiar importance in commercial geography.

Another subject that will be dealt with in scientific commercial geography is the average speed of conveyance both of passengers and goods. The determination of the average cost of transport is a consideration just as important as, in many respects even more important than, the question of average speed. This, however, has seldom been indicated, and that only in individual cases. There is still a great lack of such statistics as would enable us to give a comparative view of large commercial regions, and an even greater lack of such information when we consider the commerce of the world as a whole.

Transit trade also demands special consideration. For many territories it is this trade which is of quite vital importance. To mention only Belgium, we may call to mind the fact that on the occasion of the foundation of the International Postal Union at the Congress at Berne in 1874, that country found it necessary to protest against the free transit of foreign letters, pointing out that the number of letters sent from Belgium to foreign countries was only one-twentieth of the number that merely passed through from one country to another.

Much work has still to be done in order to ascertain the average duration of journeys. The lines that indicate the equal mean duration

of journeys from given centres, the so-called isochrons or isohemeris, are still very defective, even though the cartographical reproduction of such data goes back to Carl Ritter (1833). Goetz has drawn special maps showing in days the time taken for the transport of goods at different periods. Another attempt of the same nature was made by Mr. Francis Galton in his paper, "On the Construction of Isochronic Passage Charts" (*Proc. Roy. Geog. Soc.*, New Series, vol. iii., 1881, pp. 657-8). The accompanying map shows the time required to reach any place on the globe (from London). More recent isochronic maps exist for Germany and Austria.

Passing over different kinds of intercourse, as by mail, telegraph, telephone, and cable, we may glance at inland and maritime navigation, the causes, character, and results of which are carefully examined in commercial geography.

Canals connecting different seas and oceans, like the North Sea and Baltic Canal and the Suez Canal, the mouths of rivers accessible to sea-going vessels, like those of the Elbe from Hamburg, and the Thames from London downwards, and finally canals by which ports have been accessible to the giant vessels of the present day, like the North Sea Canal in the Netherlands (Amsterdam to IJmuiden), or inland places have been converted into seaports, as in the case of the Manchester Ship Canal, do not fall to be considered under the head of inland navigation. The importance of inland waterways is growing every year. An excellent synopsis has recently been given by Mr. George G. Chisholm in his paper on "Inland Waterways" (*Geog. Jour.*, July 1907).

Intermarine and interoceanic canals are of the very greatest importance. To the former belong the canal connections between the minor seas more or less cut off from the great oceans or between them and the main body of an ocean, such as the Caledonian Canal, the Göta Canal, the Kaiser-Wilhelm Canal. Under the head of interoceanic canals come the Suez Canal, and the canal now being pierced through the Isthmus of Panama.

One of the most important subjects of inquiry in commercial geography is that relating to harbours and seaports. A comprehensive and detailed morphology of harbours is still lacking. We have only a partial treatment of this subject by Richthofen, Krümmel, Wiedenfeld, Shaler, and others. But the importance of a harbour depends not merely on its morphological character, but also on the nature of the hinterland, that is on the degree in which the country lying behind is fitted to form a good market or to supply a great abundance of industrial products. A coast rich in bays and harbours but lacking a hinterland is valueless for commerce. For a large country seeking an outlet to the sea it is not necessary to have a coast everywhere well adapted for harbours; if only there are some favourably situated and formed seaports, which serve as valves for the expansion of the nation. A good example in this respect is afforded by the German Empire.

All this great apparatus of traffic relates chiefly to world commerce, which is principally based on the exchange of commodities. Nowadays one often speaks of commodities for which there is a world-market, the

most important of such commodities being grain, living animals, articles consumed as stimulants and luxuries, and raw materials.

The effect of the modern commercial organisation on different branches of industry has come to be of the highest importance. It influences agriculture and forestry as powerfully as it does mining and manufacturing industry, and last, not least, it affects the distribution between wholesale and retail trade. Nowadays it is needless to build huge granaries for the storage of surplus crops, for the distribution of such surpluses is decided by wire and steam. The fluctuations in the prices of the main means of subsistence are becoming smaller. The telegraph connects the London corn-market daily with that of Chicago and those of the Indian export towns, as also with those of Russia, Roumania, Hungary, Chile, and the Argentine Republic. The uniformity of prices resulting from such intercommunication is of very considerable importance for the markets of continental Europe which are protected by Customs duties like those of Germany and France. One may say that now a secure provision for the sustenance of the world has nearly been reached.

In the manifold development of a community organised as a state, which, as Aristotle says, is founded on the aim of living together, trade and commerce are of the greatest importance. Trade and commerce have Europeanised the globe, and the study of these phenomena, and especially the study of commercial geography, is becoming daily more necessary for the states taking part in the world struggle.

Commercial geography pursues a valuable aim. It is destined not only to become a new branch of science, but also to fructify older branches, such as general geography and even political economy, which will thereby acquire a fuller knowledge of their subject matter, and, last not least, cognate branches of study of more recent date, such as biography.

ANCIENT KHOTAN : A REVIEW.¹

THESE volumes, admirable in their typography and wealth of illustration, contain Dr. Stein's report on the archæological results of the explorations carried out in 1900-1901 under the orders of the Government of India in the southern portion of Chinese Turkestan, and particularly in the territory of Khotan. In them Dr. Stein has given, with amplitude of description and dissertation, an account of each of the sites explored and excavated, and has had catalogued and delineated every object gathered and preserved. In finally fulfilling this task he has been aided by various collaborators whose valuable contributions, erudite and artistic, form the lists and appendices in Volume i. and appear in the

¹ *Ancient Khotan*. By M. Aurel Stein, Indian Educational Department. Vol. i. Text with descriptive list of antiques, etc. Vol. ii. Plates of photographs, plans, etc., with a map of the territory of Khotan from original surveys. Oxford: at the Clarendon Press, 1907. Price, £5, 5s. net.

illustrations of Volume ii. Their share in completing the crowning work of his laborious and vigilant researches is duly acknowledged in the Introduction to Volume i. In it also are set forth briefly the circumstances under which the explorations were undertaken and carried out, and the principles of archæological research which guided him in his examination of sites and objects, and in recording and correlating its results.

Readers of this *Magazine* are already familiar in a general way with Dr. Stein's journey and explorations. In the July number of 1902 (vol. xviii. p. 391) a summary was given of his "Preliminary Report" upon them (dated 5th October 1901). And in the number for November 1903 (vol. xix. pp. 581-9), the *Magazine* contained a review of the "Personal Narrative" of his journey, published in April 1903 under the title of *Sand-buried Ruins of Khotan*. It is unnecessary therefore formally to introduce Dr. Stein and the regions visited by him to readers of the *Magazine*, and to repeat what has been said in it about him as explorer, scholar, and author, or again go over the personal incidents and topographical and scenic details of his journey and discoveries. In these respects it is sufficient to say that the general reader will find in these most interesting volumes very much more than a repetition or *réchauffé* of the previous books. Further, these volumes cannot fail to secure the admiring appreciation of Oriental scholars and antiquarians throughout the world, at once for the mass of material gathered and authorities consulted, for the elaborate carefulness with which their collection and examination were carried out, and for the truly scientific method—thorough, cautious and well-balanced in tone, and clear and precise in style—in which the material, in all its diversity and multiplicity, has been described, and the results of its examination recorded. The book is in fact a model of scientific antiquarian inquiry, reasoning, and description.

Dr. Stein is first and foremost an archæologist, rather than a geographical pioneer in new and unbeaten tracks. Yet with the assistance of his Indian surveyor he did much important survey and topographical work on the journey through the mountainous regions between Kashmir and Kashgar and in the Kun-lun ranges bordering the south-western portion of the Tarim Basin. All his researches into history, ethnology, linguistics, epigraphy and art in these regions and in Chinese Turkestan were related more or less to their ancient and modern geography. His route led him, in general, through the same territories and places of high Asia and Turkestan as were visited by the famous Chinese pilgrims Fa-hsien, Sung Yün, and Hsüan-tsang, and by Marco Polo, the prince of mediæval European geographers. The footmarks of all these travellers he traced on his own journey and has identified in the volumes before us. And, most appropriately, the volumes are dedicated to the memory of Sir Henry Yule, whose name will always be conjoined with that of Marco Polo as the Venetian's collator and exponent.

Unique, and interesting in the extreme as Dr. Stein's explorations were, however, it is to be noted that the history of Khotan and the adjacent tracts

of Chinese Turkestan does not reach back into the hoar antiquity which we are accustomed to associate with the East—the antiquity of the countries of Asia and Africa which lie around and north of the Persian Gulf, and around the Levant and south-eastern coasts of the Mediterranean. Compared with the histories of the civilisations—the political, commercial, religious and literary systems—developed long ages before the Christian era in Chaldaea, Egypt, Phœnicia, Asia Minor, Persia, and Greece, that of Turkestan is short, and its antiquarian remains are recent and unimpressive. The racial origin of the early occupants of Kashgar and Yarkand, the most western of the Turkestan oases, has not been discussed by Dr. Stein. But he shows that our historic knowledge of these territories begins, through Chinese annals, in the second century before Christ, while the monumental and literary relics found in them—trifling in number, diversity, and preservation compared with those discovered further east in Turkestan—mostly date from well within the Christian era; indeed, of the position of Kashgar and Yarkand cities no definite indication is contained in any recorded notice till early in the sixteenth century A.D. Kashgar, however, lies on what, doubtless from time immemorial, was a frequented line of communication through Central Asia between the interior of China in the Far East and the regions on and beyond the Jaxartes and Oxus on the west—the route, namely, along the southern foot of the T'ien-shan Range north of the Tarim River, and out of the Tarim basin by the Terek Pass into the ancient Sogdiana and Baktria. Lying as Kashgar thus did, on the highway of restless and warlike tribes, its political condition within historic centuries has been what might be looked for. At different times it has been subject to Chinese of various dynasties, to Indo-Sythians, White Huns, Western Turks, Tibetans, Arabs, Karluk Turks, Kalmaks, Mongols, and finally again to Chinese. Whatever ingredients these various invaders and rulers may have contributed towards the formation of the population now inhabiting Kashgar and Yarkand, to them there has probably been added a considerable nomad Kirghis element, the smaller proportion of which in the Khotanese population further east seemed, to Dr. Stein's eye, to differentiate it, in physical appearance, from that of Kashgar.

Of the primitive religion of Chinese Turkestan nothing seems to be known. The Buddhism of Kashgar was that of the school of the "Little Vehicle," introduced apparently soon after the commencement of the Christian era. It is thought to have come, through its Indo-Sythic rulers, from Baktria and the west, rather than from India and the south. From the west also Zoroastrianism and Nestorian Christianity advanced in the early Christian centuries into Kashgar, and were transmitted to China. The latter religion survived the introduction of Islam into Turkestan, and was still extant, if not flourishing, in the thirteenth century, in the time of Marco Polo, who found the country subject to Kublai Khan, "the Great Caan." In the eighth century Kashgar was occupied by the Arab General Qutayba, then in alliance with the Tibetans who were at war with the Chinese. But the power of China reasserted itself, and not till the tenth and eleventh centuries did Islam under the chiefs of

the Karluk tribe of Turks, the successors of Satok Boghra Khan, become supreme in Turkestan. With the rapid extinction of Buddhism which followed the establishment of Islam, Buddhist buildings and records fell into neglect and decay; and it doubtless was in part owing to the long-continued political vicissitudes of Kashgar and the eager iconoclasm of its Muslim conquerors that, in comparison with the more secluded oases to the east, the fewer ancient sites which are found in Kashgar and Yarkand have been less prolific than they in archæological "finds."

The principal of these eastern oases is Khotan. But in physical origin and in population they all, beginning from Karghalik on the west, seem in the main to be alike. Situated at the *débouchement* on to the plain of the rivers flowing from the rugged and barren Kun-lun ranges, they owe their existence to the silt deposited by those rivers and to the facilities for irrigation furnished by them. Bastioned on the south by the Kun-lun and divided one from the other by spaces of inhospitable waste, the oases are hemmed in on the north by the vast sands of the Tarim basin and overshadowed throughout a great part of the year by its fierce sand-laden winds. Time out of mind, apparently, an important and profit-yielding trade route has run through them east and west (one notable article of commerce being the jade dug out of the Kun-lun valleys). But they have always remained in a comparative isolation unknown to Kashgar.

It would seem from such evidence, anthropological and philological, as is available—human bones were apparently not obtained by Dr. Stein—that the stocks of mankind whence the present population of these oases was derived had no predecessors which have left palpable traces of themselves; and that the oldest historical evidence regarding man in them dates back only to the centuries immediately preceding the Christian era. One of the component ethnic elements of the population is described as Eastern Iranian, and therefore Aryan. It came from the west, and unalloyed representatives of it are said to be seen in the existing Galcha tribes of the Pamirs, the "Tajik" Wakhis and Sarikolis, and in the Pakhpos of the valleys above Karghalik. With this Iranian element were combined Turki, Tibetan, and Chinese elements—the first having come from the north and west, the others from the east. The first was probably not introduced (and then perhaps not very largely) until the eleventh Christian century, the Buddhist kings of Khotan having stoutly maintained their independence against Muslim dominion. The Tibetan and Chinese elements were doubtless of much earlier introduction than the Turki. They were probably present before the temporary supremacy of the Tibetans in Turkestan in their contest with the Chinese in the seventh century A.D. Whether they were antecedent or subsequent to the Iranian in their advent in Khotan can never perhaps be determined. As in the case of that stock with its "unknown" Iranian language, distinct traces of the individuality of the Tibetan element were left and preserved in the "unknown" Proto-Tibetan tongue found in texts unearthed by Dr. Stein in Khotan.

A further possible ethnic element in the Khotan population is indicated by legend, religion, and language. Of a primitive religion

in Turkestan, as already remarked, there is apparently no trace. The sole prevailing pre-Islamic religion within historic time was Buddhism, but in Khotan and the east, Buddhism of the "Great Vehicle" school. That this Buddhism came from India across the Kara-koram seems clear; and legend connects its introduction into Khotan with the pre-Christian era of Asoka and the Indian region of ancient Taxila. Dr. Stein is evidently disposed to think that the introduction of Buddhism accompanied, or at any rate followed, an early immigration of Indians into Khotan; and this immigration led not only to the complete extension of Buddhism with its Sanskrit language and script, but to the use in Khotan of an Indian Prakrit dialect and cursive Brahmi and Kharosthi writing.

The ethnological and philological relations of pre-Islamic Khotan were therefore sufficiently remarkable. They illustrate once more the undaunted perseverance with which the races of human kind push their way, however rough and perilous the paths, over the face of the globe. Its population was derived from Iranian, Indian, and Mongoloid stocks; its languages were Iranian, Indian (Sanskrit and Prakrit), Proto-Tibetan, and Chinese, written mostly in the Sanskritic Brahmi and Kharosthi, and in Chinese characters. With the advent of Islam the philology as well as the religion was changed completely. The various tongues and modes of writing disappeared, and Turki became the one language commonly used. But the ethnological quality of the population underwent little change. The chiefs of Khotan were for centuries the vassals of China. During the struggle between China and Tibet in the seventh and eighth centuries A.D., in which the supremacy of China over Turkestan was for a time suspended, they became subject to Tibet. From this subjection they were probably released, and Chinese influence restored, when the Tibetans were overcome by the Uigurs; and, as we saw, not till the eleventh century were the Khotanese brought under the Turks and Islam. Since then Mongols and Chinese have ruled them. But these political changes have, in the course of centuries, had little effect upon their ethnic condition and upon their characteristics, physical and psychical. The Khotanese of to-day to all appearance possess the same physical, mental, and moral attributes, the same general disposition and accomplishments, with the single exception of love of study, which struck all the early travellers as being characteristic of them.

Of the nature of the civilisation and manner of human life prevailing in Khotan in pre-Islamic times, Dr. Stein's archæological collections afford numerous indications. To enter into details in respect to these would occupy more space and time than is here at our disposal. It may be said in a few words, however, that the material and social life and the culture of the Khotanese seem to have been of a fairly advanced and well-regulated type. They were largely the result of influences from India (more especially Gandhara) on the one side, and from China and Tibet on the other. But articles of later Greek, and even of Roman, design give proof of intercourse with countries far to the west. The cult of Buddhism, with its temples and monasteries, its paintings and writings, was a prevailing feature of the civilisation. Borrowing and lending, buying and

selling went on in coin of both the West and the East. The people were comfortably clad and housed. Yet the use of stone, and even of kiln-fired bricks, in construction and ornament was unknown, and their domestic and public buildings consisted of wood, adobe, and plastered wattle. Paper, birch-bark, and palm leaves seem scarcely to have found place in their libraries and offices: their writing was mostly committed to and transmitted on wooden tablets, wooden slips, and leather. The people were fond of colour and decorative art. Few articles made with the precious metals and precious stones are among Dr. Stein's "finds." But the presence of gold dust in the soil of abandoned sites perhaps indicates the extensive use of gilding in the decoration of temples and images. The nature of the physical environment of life is also traceable. Internal disorder and invasion by enemies from without doubtless brought about shiftings of the population. But Dr. Stein's excavations, exposing the state of a number of evacuated towns and villages, show that abandonment did not always take place in haste and alarm. Whatever the iconoclastic proclivities of Islam, the chief sites excavated had been given up long before Khotan was entered by Mahomedans. The forces of nature, of old as now, contributed largely to the desertion of old settlements.

As bearing upon this subject, Dr. Stein has carefully described the physical geography of the Turkestan oases. He has shown how, as they tail off into the wastes of the Tarim basin, the silt-laden waters of their snow-fed rivers are liable in flood time to wander right or left as they find a way among the undulations made by the driving and eroding winds and by the silt deposits of previous years: how where used near their *débouchement* from the hills for irrigation, these waters tend gradually to raise the level of the cultivated land with their silt, and to leave in hollows the inhabited sites and uncultivated ground: how the soil which now covers the ancient buried sites consists not of the sand of the central Tarim desert, but of the loess silt which once on a time had been rolled down by the rivers from the Kun-lun valleys, and when desiccated under the torrid heat of summer had been taken up and re-deposited by the winds. It is only by persistent struggle that the irrigation of cultivation in these oases can be kept up, and without irrigation the splendidly fertile loess soil is valueless. The forces just alluded to are ever tending to change the course and scope of the irrigation; and any slackening of human effort, whencesoever resulting under the unstable conditions of human existence, must accentuate their modifying power and help to obliterate the agricultural settlement. Actual experiences of the kind have taken place within human memory; and although it is possible, nay probable, that a secular climatic change in the form of increasing desiccation is going on in the Tarim region, it is evident that the physiological forces now plainly observable may reasonably be held to account for the phenomena of the past.

As an Indian official who has been witness of the effect and efficiency of scientific irrigation in the Punjab, Dr. Stein saw the wide field that lies open in Turkestan for similar operations. What productive tracts might not these oases become were their water resources made use of

and controlled by scientific hands! Population may at present be scant; but in such lands and among such Eastern peoples, where favourable agricultural conditions are secured, population soon gathers and increases. An enlightened, stable, and progressive government is all that is wanting. With the re-awakening of the Far East that may still be to come.

MANUSCRIPT MAPS BY PONT, THE GORDONS, AND ADAIR, IN THE ADVOCATES' LIBRARY, EDINBURGH.

By C. G. CASH, F.R.S.G.S.

IN August, 1901, I published in this Magazine an article entitled "The First Topographical Survey of Scotland," giving an account of the preparation of the maps that appear in the Scottish volume of Blaeu's *Atlas*. In the last section of that article I referred to a volume of manuscript maps in the Advocates' Library, these being original sketch maps by Timothy Pont, map studies and partly finished maps by Robert Gordon and James Gordon, and maps prepared for Sir Robert Sibbald by John Adair.

The volume was catalogued as "Collection of maps drawn by Timothy Pont the celebrated geographer who prepared the 'Theatrum Scotiae' about the year 1608, with a number of maps drawn by John Adair circa 1680." In the Index Catalogue the entry was "Pont (Timothy) geographer. Collection of maps drawn by Timothy Pont, about the year 1608; also a number of maps drawn by John Adair, circa 1680. Miscel. 143." The printed title on the back of the volume was "Pont's Maps of Scotland circa 1608." On a page at the beginning of the volume was this entry in manuscript, "These maps were drawn by Timothy Pont, the celebrated Geographer, who prepared the 'Theatrum Scotiae,' about the year 1608 (see Chambers's *Biog. Dict.* vol. iv. p. 119). W. H. H. A number of maps by *John Adair* are bound in at the end of the volume, circa 1680." Some errors in these entries have previously been sufficiently pointed out.

In my previous article I wrote somewhat strongly as to the unsatisfactory condition of these maps, and the need for and desirability of proper and conservative treatment of them, and I made some suggestions to that end. These suggestions were brought before the Curators of the Advocates' Library and before the Publications Committee of the Royal Scottish Geographical Society, but various circumstances prevented any action being then taken. I continued, however, as opportunity offered, my own studies of the maps, and gradually acquired a considerable knowledge of them, and accumulated a body of notes in regard to them. By reference to other manuscripts in the Advocates' Library I became so far acquainted with the scripts of Pont, the two Gordons, and Sibbald, that I could recognise them on the various maps; the signed maps also gave a clue to the styles of cartography; and so I ventured a classification as to authorship that left very few doubtful cases. One feature

that for a time caused me some doubt is that many maps are endorsed with a place-name followed by the initials "M. T. P.," standing for "Magister Timothy Pont." At first I was inclined to suppose that this indicated that Pont had drawn the maps; but it afterwards became evident that though in some cases this is so, in others its meaning is that the map was compiled from the surveys of Pont. Speaking generally the Pont maps are distinguished by a roughness of execution, and by being ruled in surveyor's squares. In some cases his work, when very much faded, has been worked over or added to by one of the Gordons. The Adair maps are quite easily distinguished by their special style of execution.

In the course of my close examination of the maps, I found that some of them had mapping and script text on the back. All such work was of course hidden by the mounting; but by dint of careful inspection on days of brilliant sunshine, I succeeded in ascertaining in several cases what district the mapping dealt with, and it became evident that interesting work was concealed.

Early in the present year I learned that the process of deterioration of the volume had gone so far that repairs were imperatively necessary, and that the volume was ordered for re-binding. At once I placed myself in communication with Mr. W. K. Dickson, the new Keeper of the Library, sending him a copy of my previous paper, repeating my suggestions, and offering my services in connection with any possible re-arrangement and re-mounting of the maps. Mr. Dickson had been paying much attention to the valuable collection of manuscripts under his care, and at his request I submitted a somewhat detailed report on the condition of the volume and its maps, and on what treatment of them seemed desirable. Then he and I consulted with Messrs. Waterston as to how far my recommendations were feasible within certain limits of expense, and as the outcome of the conference the volume was entrusted to them for treatment, and they have taken much personal interest in the problems the work presented.

The first step was to number the maps consecutively in the order in which they were then bound, so that subsequent identification would be easy. Then all the maps were dismounted. It is curious to see in how many cases several pieces of paper had been conjoined to make a large sheet, as though paper had been expensive. Again, in many cases a piece of a map had been excised, presumably because erroneous, and a fresh piece of paper had been patched on in its place. These joinings and patchings made the process of dismounting old and in many cases frail papers a difficult and delicate one. Again, in some cases the ink was much faded, and there was the danger of still further fading if the maps were wet. But Messrs. Waterston's binder, Mr. George Tod, is a man of technical knowledge and skill, cautious and conservative, and keenly interested in such a piece of work. In the most perfectly successful manner he removed all these precious papers from their mounts without, as far as I can see, any damage at all. It was then comparatively easy for me to sort them into three sets according to authorship, a Pont set a Gordons set, and an Adair set. The maps in each set were then

arranged topographically, working through the map of Scotland from north and west to south and east.

When the sheets were all dismounted, I examined the maps and text on their backs, and arranged for the proper "inlaying" of some sheets so as to expose any work that seemed of value. Mere name endorsements or unimportant scribble mappings are not exposed in the new mounting, and it has, unfortunately, been impossible to expose the mapping on the back of No. 5 of the Gordon maps. But I have made a careful traced copy of this map, and this copy is bound in with the maps. The rectangular blank in this copy shows where a piece of the paper had been cut out in making a change in the mapping on the face of the sheet, where the new patch will be readily recognised.

When these maps passed into the possession of Sir Robert Sibbald, he endorsed many of them, and also entered lists of some of them in his *Repertory of Manuscripts* (Advocates' Library press-mark 33'3'16) and *Collections for the Description of Scotland* (Advocates' Library press-mark 33'5'15). In the former he catalogues sixty-five maps as "Maps done by Timothy Pont M.S.," but he professes only to "give the titles of the most remarkable of ym." In the latter he catalogues forty-eight manuscript maps, "brought to me by Mr. Gregory fra ye person of Rothemay," and seven of Adair's maps. I cannot reconcile Sibbald's two lists with each other, nor in every case identify the maps in them. It is obvious, as he states, that he did not catalogue some of the maps he received, and I think that he is sometimes in error as to authorship.

In the following lists the maps are numbered consecutively in the order in which they are now re-bound in three volumes. When a title appears on the face of the map, it is quoted as "Title"; when there is a title on the back, it is quoted as "Endorsement," abbreviated to "End." A brief statement is made as to the district shown in each map, the style of workmanship, and anything noteworthy in regard to the map. I use the word "script" to indicate letters of the ordinary manuscript shape, and the word "print" to indicate letters of Roman or Italic printed shape, though done with the pen. We seem to have no special word for manuscript-printing. It is to be remembered that all these maps are hand-done, except the one "proof," No. 6 among the Adair maps. The entries with bracketed numbers are:—(1) the size of the sheet, in inches; (2) the size of the mapping, in inches, in each case first north to south then east to west; (3) the scale given, in number of miles intended to be represented by one inch; (4) the actual scale, in number of miles actually represented by one inch.

The titles and endorsements of these maps are in various hands. On the Pont maps are such entries by Pont himself, and by the Gordons and Sibbald. The Gordon maps have been written on by their authors, and often also by Sibbald. The Adair maps bear no marking except that by Adair. It is usually possible to recognise the different scripts, and after each quoted title or endorsement of the Pont and Gordon maps I have given in square brackets the initials of its writer, but some of these identifications are not certain.

In several cases the maps bear definite statements of authorship or

date. Such statements appear on Pont maps Nos. 10, 11, 13, 15, 20, 21, and 34, and on Gordon maps Nos. 4, 9, 11, 25, 26, 28A, 32, 36, 37, 41, 52, 53, and 62. I have already said that "M. T. P." is not a conclusive marking; but I consider that the entry "R. G." sufficiently indicates Robert Gordon as the author of a map.

MANUSCRIPT MAPS BY TIMOTHY PONT.

1. End: "Kyntail. M. T. P." [R. G.]. A very rough sketch map of Lochs Erriboll, Tongue, etc. The map is confused by lines of corrections and cancelling. (1) 12×12 . (2) 11×12 . (3) —. (4) c. 1.

2. Title, "Mapp of Strathnavern." [R. S.]. End: "Strathnaverne. M. T. P." [R. G.], and "Mapp of Strath Nauern." [T. P.]. A rough sketch map in much detail of the country draining to the north coast, from Cape Wrath (called here Faro Heade) to the mouth of the R. Halladale. The work is mostly in small script, and the names read from the east. There are many script notes, especially along the coast. (1) $12\frac{1}{4} \times 16\frac{1}{2}$. (2) $12\frac{1}{4} \times 15\frac{1}{2}$. (3) —. (4) c. $3\frac{1}{2}$.

On the back there is script, and mapping of the same district.

3. End: "Edera-chewles. M. T. P." [R. G.]. A fairly detailed map of the coast in the Edrachilles district, ruled in squares of about $\frac{1}{8}$ inch sides. The work is very rough and untidy; several parts are cancelled, and some parts have been drawn twice. There are several manuscript notes. Two entries are, "Extreem Wilderness," and "Many Woolfs in this . . ." The names read from the east. (1) 16×11 . (2) 16×11 . (3) —. (4) c. 3.

4. Title, "Part of the Back syde of Rosse." [R. S.]. End: "Part of the back syde of Rosse. M. T. P." [R. G.]. The sheet carries six very rough sketch maps of parts of the north-west coast; some parts of the script are difficult to read. (1) 16×12 .

On the back there is script, and mapping of Loch Assynt, etc.

A. Probably the neighbourhood of Loch Laxford. (2) $2\frac{1}{2} \times 1\frac{1}{2}$. (3) —. (4) —.

B. The neighbourhood of Loch Laxford. (2) $2\frac{1}{2} \times 1\frac{1}{2}$. (3) —. (4) 4 or 5.

C. The profile of some mountains, probably between Maree and Torridon, but hopelessly confused. (2) $1\frac{1}{2} \times 3\frac{1}{2}$. (3) —. (4) —.

D. Title, "Yis is ye coast be south Loch Eu." [T. P.]. The coast from Loch Ewe to Loch Torridon, but utterly vague. (2) $7 \times 2\frac{1}{2}$. (3) —. (4) c. 5.

E. Loch Carron with the River Carron, and Loch Alsh. (2) $7 \times 8\frac{1}{2}$. (3) $2\frac{1}{2}$. (4) c. 3.

F. Loch Broom, Little Loch Broom (called Loch Carllen), and Loch Gruinard, with their rivers. (2) 8×10 . (3) 2. (4) 2.

5. End: "L. Ness, Abertarf, Glengariff, Stranarnn, & Seats in Murrey, Glenmorisdenn, Vrwodynn, Straharkegg." [T. P.], and "Loch Ness, Abertarf, Straharkeg, Glenmorisdenn, Vrwodynn, air L." [T. P.],

and "Seats in Morray." [T. P.]. Map of Glenmore, with Lochs Garry and Quoich. The work is somewhat rough print and script. The names read from the north-east. The sheet is ruled in squares of about $\frac{7}{8}$ inch sides. (1) $25 \times 13\frac{3}{4}$. (2) $25 \times 13\frac{1}{2}$. (3) ——. (4) c. 2.

6. Title, "Abernethy & ye draught of Spey." [R. S.]. End: "Abernethy & ye draught of Spey. M. T. P." [R. G.], and "All Straspay in Mappe." [T. P.]. A detailed map of the River Spey from just above Craigellachie and "Auymoir" to a little below Fochabers, and the River Nethy. The work at the mouth of the Spey is illegible; the drawing goes right to the edge of the paper, but there is no suggestion of a sea-coast. The junction of the Nethy with the Spey is not shown; the Spey has there been drawn wrongly and then corrected, but the Nethy has not been joined to the new drawing. A part of the River Avon is shown. The work is rough, and much of it has been done over. The names read from the north. The sheet has been ruled from east to west at intervals of $\frac{3}{8}$ inch. (1) $16 \times 11\frac{1}{2}$. (2) $16 \times 11\frac{1}{4}$. (3) ——. (4) c. $2\frac{1}{2}$.

On the back there is mapping of the Nethy and its tributaries.

7. Title, "Strath Avin & Glen Tanner." [R. S.]. End: "Strath Avin, Glen Tanner." [R. G.], and "The draught of the river of Awin from the springs to the Inver yrof." [R. G.]; most of this second endorsement is on the back of No. 18, the two maps having been drawn on one sheet and cut apart. This sheet bears four maps. There is much detail, and the work is in good but stiff black printing over very faded brown, but with many names not re-written. The re-writing seems to be Robert Gordon's work. The general effect is untidy. The sheet is ruled in squares of about $\frac{1}{3}$ inch sides. (1) 12×12 .

A. In the middle of the top part of the sheet is a rough profile sketch of Ben Lawers. (2) $2\frac{3}{4} \times 3\frac{1}{2}$. (3) ——. (4) ——.

B. Title, "Glen Tanyr." [T. P.], in the upper left-hand part of the sheet. The hills are drawn strongly. The names read from the north, the south being at the top of the map. (2) $5\frac{1}{2} \times 5$. (3) ——. (4) c. 3.

C. Title, "The laich of Strath Avin, it is evil and wrong." [? R. G.], in the upper right-hand part of the sheet. This is the lower course of the Avon, which in the earlier draught was plotted twice. It is "evil and wrong," for the Liffet is drawn as entering on its left bank, and the Brown on its right. (2) $4\frac{1}{2} \times 3\frac{1}{2}$. (3) ——. (4) c. 3.

D. Title, "Strath Avin." [? R. G.], occupying the lower half of the sheet. Does not include the upper course of the Avon, but shows the Builg and the junction of Avon with Spey. The lower part of the district has not been re-worked. (2) $6\frac{1}{2} \times 11\frac{1}{2}$. (3) ——. (4) c. 3.

8. Title, "Mapp of Murray." [R. S.]. End: "Murray. M. T. P." [R. G.], and "Murray." [T. P.]. The map extends from the Lossie to the middle of Loch Ness, and from the coast to the sources of the rivers. The work is in somewhat coarse print, but this is one of the neatest of the Pont maps. (1) 13×17 . (2) 12×17 . (3) $2\frac{3}{4}$. (4) $3\frac{1}{4}$.

9. Title, "The coast betwixt Spey and Diberne." [R. S.]. End:

"All the coast betuixt Spey and Doverne. M. T. P." [R. G.], "Enzei Boyn & Bamph." [T. P.], and "Mapp of Enzie Boyne and Bamf." [T. P.]. A detailed map, covering about eight miles inland. An inset in the top right-hand corner gives a piece of Banffshire east of the Deveron. The work is in rough semi-cursive print. The names read from the south-east. (1) $13\frac{1}{2} \times 16\frac{3}{4}$. (2) 13×15 . (3) —. (4) c. $2\frac{1}{4}$.

10. Title, "Buqhan from Ythan River to Duverne by Tim. Pont." [R. S.]. End: "M. Timothe Pont. Buquhan from Ythan river to Dovern." [R. G.]. The western boundary curves outwards from the mouth of the Ythan to Banff. There is much detail in coarse printing; in the southern half, the names are printed parallel to the curved boundary. The sheet is ruled with faded red ink into squares of $\frac{3}{4}$ inch sides, "Eurie one of these dimensions do little exceed half a myle." The actual scale is uneven, and seems to increase northwards. (1) $13\frac{1}{2} \times 16\frac{1}{2}$. (2) $13\frac{1}{2} \times 16\frac{1}{2}$. (3) c. $1\frac{1}{2}$. (4) $1\frac{3}{4}$ to 3.

11. Title, "Both ye sides of Dee fra Kinkairn to Aberdeen by Tim. Pont." [R. S.]. End: "Both syds of Dee fra Kincarn to Abirdene Mr. Timothie Pont." [R. G.], and, "Marr. all Dee R . . ." [T. P.], partly illegible. The work is in fairly neat print and script, but so much rubbed as to be not easily legible in some parts. The coast has been much corrected. The names read mostly from the east. There are some notes in Robert Gordon's script. (1) $13 \times 16\frac{3}{4}$. (2) $13 \times 16\frac{3}{4}$. (3) —. (4) c. 2.

12. End: "Loch Lyon. M. T. P." [R. G.]. The map shows Lochs Linnhe, Eil, and Leven. It is ruled in squares of about $\frac{3}{4}$ inch sides. The work is fairly neat print over faded script; some of the script is not done over, and there is also more recent script. (1) $12\frac{3}{4} \times 11\frac{1}{4}$. (2) $11\frac{1}{2} \times 8$. (3) —. (4) c. 3.

There is mapping on the back, "Part of Rannach."

Along the top edge of the sheet there is an illegible fragment of a map, "Of Cowell, Lochaw, and Lorn," dealing with the neighbourhood of Loch Fyne.

13. Title, "A Description of Maimoir in Lochabir wt. ye placis adioyning be Mr. Timothee Pont." [T. P. and R. G.], "be Mr. Timothee Pont" being added by Gordon. A very detailed, well-executed, and clear map of the district between and round Loch "Yiel" and Loch "Lyon," *i.e.* Eil and Leven. The work is in large, stiff, clear print, and the general effect of the map is strong, bold, and clear. The sheet is ruled faintly in squares of $\frac{5}{12}$ inch sides. This is the best finished of the Pont maps. (1) 16×14 . (2) 15×12 . (3) $\frac{4}{5}$. (4) $\frac{4}{5}$.

14. End: "Coull, Lorne, & Lochaw." [R. S.]. Map including Lochs Awe, upper Fyne, Long, Ridden, Striven, Holy, and Gail, and the north part of the Isle of Bute. There is much detail in neat print, somewhat faded. The sheet is ruled in squares of about $\frac{1}{3}$ inch sides. (1) $12\frac{1}{4} \times 19\frac{1}{2}$. (2) 12×19 . (3) $2\frac{3}{4}$. (4) $2\frac{3}{4}$.

15. End: "Part of Couel comonlie called Cowl to witt Glastree &

Ardskeodenish, al yis in Argyll & Lorne be Mr. Tim. Pont." [R. G.], and "Glastree & Ardskeodenish." [T. P.]. A detailed map of the district between Loch Fyne and Jura Sound near the River Add. The work is fairly neat print. The names read mostly from the west. The sheet is ruled in squares of $\frac{5}{12}$ inch sides. (1) $5\frac{3}{4} \times 5\frac{1}{4}$. (2) $5\frac{3}{4} \times 5\frac{1}{4}$. (3) —. (4) c. 2.

On the back is an almost illegible "Mem. to Loch syinn."

16. A detailed map of the district round Lochs Gare, Long, Goil, Holy, and Eck. The work is fairly neat print. The sheet is made up of several pieces of paper patched together. (1) $7\frac{3}{4} \times 9\frac{3}{4}$. (2) $7\frac{1}{2} \times 9\frac{1}{2}$. (3) $2\frac{1}{2}$. (4) 2 to 3.

17. End: "Loch Lomund and all his yles in Map." [T. P.]. A map of Loch Lomond and the heads of the neighbouring sea lochs; it includes Loch Ard and the beginning of the Forth. The work is partly neat small print and partly script; it has faded, and some parts have been done over. There are several meaningless wavy lines. The sheet is ruled in squares of $\frac{2}{5}$ inch sides. (1) 16×11 . (2) 16×11 . (3) c. 2. (4) 2.

18. Title, "Loch Tay." [T. P.]. End: "Loch Tay." [R. G.]. A map of Loch Tay and the beginning of the River Tay. Near "Weemb" the river has been drawn three times, two of the drawings being cancelled. The work is fairly neat print and script, some of it done over. The sheet is ruled in squares of about $\frac{1}{3}$ inch sides. This map and No. 7 were drawn on the same sheet, and cut apart. (1) $5\frac{1}{4} \times 12$. (2) $4\frac{3}{4} \times 11\frac{3}{4}$. (3) —. (4) c. $2\frac{1}{2}$.

19. Title, "Mapp of Garry & its Branches." [R. S.]. A map of the River Garry above the junction of the Tilt, including part of "L. Eyracht" and the upper waters of the River Tromie. There is much detail in neat print, most of it having been done over. The sheet is ruled with red ink over older faded red ink in squares of $\frac{2}{7}$ inch sides. (1) $12 \times 13\frac{1}{4}$. (2) $9\frac{1}{2} \times 12\frac{1}{2}$. (3) —. (4) c. 3.

20. Title, "This pag qpryseth all the Branches and River of Tilt compleetlie, be Mr. Ti. Pont." [T. P. and R. G.]. End: "Glentilt. M. T. P." [R. G.]. A detailed map of the River Tilt and its tributaries, including also the River Dee from the Chest to Braemar, the River Geldie, and the Ey Burn. The work is in faded brown ink, and seems to have been done over. Some slight additions are in Robert Gordon's script, including "be Mr. Ti. Pont" in the Title. (1) $12\frac{1}{4} \times 8$. (2) 12×8 . (3) $2\frac{1}{4}$. (4) c. $2\frac{1}{4}$.

21. Title, "The Draugt of Strath Erin be Mr. Timothee Pont." [R. G.]. End: "Strath-Iern and pt. of Glen Amont in Mappe." [T. P.], and "Strath-eryne and Glen Almond M. T. P." [R. G.], with the added note "Glen almond is not drawne out heer yeat Jany 1637." [R. G.]. A detailed map of Strath Earn. The work is fairly neat print, in black ink over faded brown. The sheet is ruled in squares of less than $\frac{1}{2}$ inch sides. A scale is ruled, but has neither names nor figures. In the top

right-hand corner is a cancelled sketch map of part of Glen Almond. (1) $10\frac{1}{4} \times 14\frac{1}{2}$. (2) $10 \times 14\frac{1}{4}$. (3) 12. (4) c. 2.

22. This sheet bears two maps. The whole sheet is ruled in squares of $\frac{2}{5}$ inch sides. (1) $10\frac{1}{2} \times 14$.

A. Map of the district along the south side of the River Earn between Drummond Castle and Forteviot. There is good detail in fairly neat print, some of it done over. All the names read from the north. (2) $5\frac{1}{2} \times 9\frac{1}{2}$. (3) —. (4) c. 2.

B. Title, "Glenalmond. M. T. P." [R. G.]. A detailed map in fairly neat print, some of it done over. (2) $6\frac{1}{2} \times 12$. (3) —. (4) c. $2\frac{1}{2}$.

There is some very rough mapping on the back, with the title, "Lochabre. M. T. P." [R. G.], and some script about the same district.

23. This sheet bears two maps; it is ruled in squares of about $\frac{3}{8}$ inch sides. (1) $12\frac{1}{4} \times 12$.

On the back there is some illegible endorsement, and also some verse, "The . . . of St Philip Sydney."

A. End: "Howe of Taye and Tilt. M. T. P." [R. G.]. A map of the River Tay from Loch Tay to Dunkeld, with Rivers Tummel, Garry, and Tilt. The name "Timmell fl." is given to the Tilt as well as to the Tummel. The work is somewhat rough print and script. (2) 10×12 . (3) $1\frac{2}{5}$. (4) c. 2.

B. A map of the Lunan Burn, a tributary of the Isla. The work is somewhat rough print and script, and much of it has been done over; there are also several corrections. The two maps are imperfectly separated by an irregular line. (2) $6\frac{1}{4} \times 6\frac{1}{2}$. (3) c. 2. (4) c. $1\frac{1}{2}$.

24. Title, "Country above Perth." [R. S.]. End: "The countrie above Perth. M. T. P." [R. G.]. A map of that part of the Tay basin that lies west of the River Tay, and between Perth and the River Bran. The work is moderately good print, in somewhat faded ink. (1) $8 \times 7\frac{1}{2}$. (2) $7\frac{1}{2} \times 7\frac{1}{4}$. (3) —. (4) 2.

25. Map of the River Tay from Dunkeld to Benchil, and part of the Isla. The map has been cut out of a larger sheet, and is ruled in squares of about $\frac{1}{3}$ inch sides. The work is rather untidy print in faded ink over faded script. (1) 7×8 . (2) 6×7 . (3) —. (4) 2.

On the back there is rough mapping of the country from Ben Nevis to Blair Athol.

26. End: "Angus." [R. G.], and, in pencil, "Angus & Mearns." [R. G.], and "Laich of Angus, Mr. Timothee Pont." [R. G.]. A very detailed map of the country from Perth to Arbroath. The work is fair print and fair script; two inks were used, and one has faded. The general effect is untidy; much of the work has been done over. (1) $12 \times 21\frac{1}{2}$. (2) $12 \times 21\frac{1}{4}$. (3) $1\frac{1}{2}$. (4) $1\frac{1}{2}$.

27. End: "Strathardle & Glenshey." [T. P.]. A fairly detailed map, in somewhat faded, fairly neat print, over very faded print and script. The many corrections give the map an untidy appearance. The sheet is ruled in squares of about $\frac{1}{4}$ inch sides. (1) $15\frac{1}{2} \times 11\frac{1}{2}$. (2) 15×11 . (3) $1\frac{3}{5}$. (4) $1\frac{4}{5}$.

28. Title, "Glen Yla from ye head." [R. S.]. End: "Al Glen Yla . . . in Mappe." [T. P.], partly illegible. A map of Glen Isla down to the junction of "B. Elycht," that is the Burn of Alyth. There are three insets, two of them cancelled, showing the continuation of the Isla from Airly nearly to Couper. The work is in fair print. The sheet is ruled in squares of $\frac{2}{3}$ inch sides. (1) $16 \times 11\frac{3}{4}$. (2) $16 \times 11\frac{1}{2}$. (3) —. (4) c. 2.

29. Title, "Part of Anguse." [R. S.]. End: "Pairt of Anguss. M. T. P." [R. G.]. A detailed map of the district of the South Esk and the Isla. The sheet is ruled roughly into squares of about $\frac{1}{3}$ inch sides. The work is in neat print, but has faded so that much is scarcely legible; some seems to have been done over in darker ink. There is a patch in the bottom left-hand corner. (1) 8×9 . (2) $7\frac{3}{4} \times 9$. (3) $2\frac{1}{2}$. (4) c. 3.

30. This sheet bears two maps. (1) $10\frac{3}{4} \times 14\frac{1}{4}$.
On the back there is mapping of the Norain River and the Westwater.

A. Title, "Ye draught of South Eske River or Esken Duy." [R. G.]. The work is in fairly neat print, in black ink over faded brown. There are script notes in faded ink scarcely legible. The place-names near the junction of the Prosen are illegible, and this part of the map has been twice re-drawn in the margin. (2) $7\frac{1}{2} \times 14$. (3) —. (4) 2.

B. Title, "Ye draught of North Esk River." [R. G.]. This map is separated from the previous one by a curved double line. It is done in the same style. (2) 9×14 . (3) $1\frac{1}{2}$. (4) c. $3\frac{1}{2}$.

31. Outline map of Tay Estuary from "Madlenguir" to a little beyond "Butannais." Few places are shown. There are several lines of soundings, and some anchorages. The work is in neat script. There are 32 radiants from a wind-rose in the middle of the map. (1) $13\frac{1}{2} \times 14\frac{1}{2}$. (2) $12\frac{3}{4} \times 14\frac{1}{2}$. (3) —. (4) 1.

32. End: "Sterlinshyr." [R. G.], given twice. Map of central Scotland, from the Clyde below Dumbarton to the Forth at Saltcoats, and from Stirling to the Clyde above the Kelvin. The work is in neat printing, and some of it seems to have been added by Robert Gordon. The map is ruled with red ink in squares of $\frac{1}{5}$ inch sides. (1) $12\frac{1}{2} \times 15\frac{1}{2}$. (2) $11\frac{1}{2} \times 15\frac{1}{2}$. (3) —. (4) c. 3.

33. Title, in stiff heavy print, "Baronee of Renfrew." [T. P.]. End: "Renfrow." [R. G.]. The district from the Clyde estuary southwards to Flatterstoun. The sheet is irregularly ruled in squares of about $\frac{1}{2}$ inch sides. There is much detail in fair print. The map has been cut in a very irregular line out of a larger sheet, and to the north and east it is pasted on to a sheet with ruled margin lines. (1) 10×15 . (2) $9\frac{1}{2} \times 14\frac{1}{2}$. (3) —. (4) c. 3.

34. End: "Clydsdale." [R. G.], and "Clyddsdall." [T. P.], and "The Mappe of all Cliddsdale." [R. G.]. A map of Clydesdale from Queensberry Hill to just below Glasgow. The sheet is ruled in squares of about $\frac{1}{3}$ inch sides. It bears a date in the top right-hand corner ". . . Sept. et Oct. 1596 descripta"; the first word is illegible. In the bottom right-

hand corner is an illegible note mentioning Anand, Clyde, Tweed, and Tintock. The general appearance of the map is rough, but the detail is neatly done; many names read from the north. (1) 22×15 . (2) $19\frac{1}{4} \times 14\frac{1}{2}$. (3) 2. (4) c. $2\frac{1}{2}$.

35. This sheet bears two maps. It is ruled in red ink in squares of about $\frac{1}{2}$ inch sides. (1) $20\frac{1}{2} \times 15\frac{3}{4}$.

A. Title, "Nidisdaile." [T. P.]. End: "Nidisdale." [?T. P.]. A detailed map in rough script, much scarcely legible. There are two patches, on one of which the work is in small neat print. (2) $16\frac{1}{4} \times 15\frac{1}{2}$. (3) ——. (4) c. 3.

B. In the bottom left-hand corner is a map, inverted and cancelled, of the district from Selkirk to Ruberslaw, and from Hawick to Ancrum. It is a detailed map in rough manuscript. (2) $8\frac{1}{4} \times 6$. (3) ——. (4) c. 2.

MANUSCRIPT MAPS BY ROBERT AND JAMES GORDON.

1. A Ptolemy style of map of Roman England, including part of Ireland, and showing the eastward direction of the east coast of Scotland. The work is in neat printing. (1) 8×12 . (2) $6\frac{1}{2} \times 7\frac{1}{4}$. (3) ——. (4) c. 60.

2. A map of Scotland, north of Glenmore in detail, and outline of east coast to Dunbar, showing the courses of the chief rivers, and the positions of a few places. The work is in fine neat printing. The middle part of the map is patched. (1) 13×13 . (2) $10\frac{1}{2} \times 11$. (3) ——. (4) c. 20.

3. A map of Scotland north of Loch Linnhe and River Dee, and west of River Deveron. There is much detail in fine neat printing. The map includes most of the Orkneys. The sheet is made up of several pieces patched together. (1) $27\frac{3}{4} \times 19\frac{1}{2}$. (2) $27\frac{3}{4} \times 19\frac{1}{2}$. (3) 5. (4) 7 to 8.

4. End: "Straloch's mapp of Scotland." [R. S.], and "The West coast from Glen Elg to Knap-dail." [R. G.]. An outline map of Scotland from Tarbat Ness to Tay and Jura. There is detail on all the west coast, and eastward as far as Lochs Rannoch and Tay, and also some along the Dee. The work is beautifully neat; the numerous mountains are small and pretty. The sheet has been partly ruled with pencil lines from west to east at $\frac{3}{4}$ inch intervals. In Loch Linnhe is written, "All ye coast of Lorn is according to Mr. Timothies . . ."; the remainder is illegible. (1) $19\frac{1}{2} \times 28\frac{1}{2}$. (2) $19\frac{1}{4} \times 28\frac{1}{4}$. (3) $5\frac{1}{4}$. (4) c. 6.

5. A detailed map including Glenmore, Lochs Arkaig and Garry, the basins of the Nairn, Findhorn, and Spey, Lochs Ericht and Laggan, and the River Spean; also in outline Lochs Garry, Rannoch, and Tummel. The work is very neat, but much faded, and in the Spey valley has been done over with darker ink. The names read from the north. There are multitudinous mountains of uniform pattern. (1) $38\frac{1}{2} \times 26\frac{1}{2}$. (2) 38×24 . (3) 2. (4) 2 to 3.

On the back there is a map of the districts draining to Loch Eil. As it is not possible to display this, I have made a copy of it, and the copy is attached to the back of the mount of the map.

6. A map of Eastern Scotland, including basins of Don, Dee, Tay, Forth, and Tweed. Much detail is shown, except in the lowlands between Montrose and the Tay. There is detail between Glasgow and Loch Lomond; and the west coast is partly drawn near Loch Etive. The work is fine neat printing. The sheet is made up of many pieces joined together, and also is patched. (1) 22×27 . (2) 22×27 . (3) 6. (4) c. 6.

7. Title, "A description of the East coast of Scotland drawn out of Wagoner and sumqt corrected, but it not fully perfytt & yet hath many errors." [R. G. or J. G.]. End: "Wagoners east coast of Scotland." [? R. G.]. A map of the east coast of Scotland from Strathly Point to Coquet Island. There is but little detail, and only a few names appear, in neat somewhat bold print. There are several lengthy script statements about latitudes, directions, islands, etc. There is a scale of "English & Frenche Leagues," about 4 = 1 inch. (1) $22\frac{1}{2} \times 8$. (2) $22\frac{1}{2} \times 7\frac{3}{4}$. (3) 12. (4) c. 12.

8. A map of the Mainland of Orkney, and Fair Isle. The work is neat print. The paper is patched. (1) $6\frac{1}{4} \times 6$. (2) $5\frac{1}{4} \times 3\frac{1}{2}$. (3) —. (4) c. 4.

9. Title, "Cathenesia descripta ex magna eiusdem charta quam lustravit et descripsit Timoth. Pont. Opera R. Gordonii mense Aprili, 1642." [R. G.]. End: "Cathness." [R. G.]. There is much detail, in fine neat print; the names read from the east. The sheet is ruled in pencil in squares of $1\frac{3}{8}$ inch sides. The scale given is "Scala miliarium Scotiecorum communium." (1) 12×8 . (2) $7\frac{1}{4} \times 11\frac{1}{4}$. (3) $2\frac{1}{2}$. (4) $4\frac{1}{2}$.

10. Title, "Sutherland, Strath Okel, & Strath Charron." [R. S.]. A map of the country draining to the Dornoch Firth, and the coast northwards to Dunbeath. The work is neat fine print. The paper is patched. (1) $10\frac{3}{4} \times 14$. (2) $10 \times 13\frac{1}{2}$. (3) $3\frac{3}{4}$. (4) 4 to 5.

11. Title, "The draught of Edera Cheules, lying betuix Strath-Navern and Assin, gathered out of Mr. Timothee Pont his papers, who travayled and descryved the same. By R. Gordon. 1636." [R. G.]. End: "Ederacheulis. M. T. P." [R. G.]. The work is neat, but the map is vague towards where Cape Wrath should be. Two entries are "Extream wilderness," and "Verie great plentie of wolfs doo haunt in this desert places." There is much script on the back, "Noats of Mr. Timothies anent Strathnavern &c." (1) $16 \times 12\frac{1}{4}$. (2) 16×12 . (3) $1\frac{1}{2}$. (4) c. 2.

12. This sheet bears two maps. (1) $12 \times 9\frac{1}{2}$.

A. A map of Loch "Syinn" corrected to "Shinn," showing probably all possible detail, in very neat print. There is a note on the abundance of pearl in the Loch; also one on the plentifulness and size of salmon

there, and their absence from the River Turriff. (2) $5 \times 7\frac{3}{4}$. (3) ——. (4) $2\frac{1}{2}$.

B. End: "Assyin. M. T. P." [R. G.]. A detailed but inaccurate map of Loch Assynt, Ben More Assynt, and Quinaig. The work is neat print. Just north of Loch Assynt are shown Lochs "Inberboll" and "Wairr," whose effluent is shown reaching the sea near that from Loch Assynt; this part of the map is extremely confused. (2) $6\frac{1}{2} \times 9\frac{1}{2}$. (3) 3. (4) c. $2\frac{1}{2}$.

13. End: "Coygach." [R. S.]. An outline map of the west coast from Loch "Owrin," that is Hourn, northwards to the River Kirkaig. There is not much detail; the work is very neat print. (1) $12\frac{1}{4} \times 8$. (2) 12×8 . (3) 5. (4) c. 6.

14. Title, "Coygach and Loch Breyn drawin out of many imperfyt papers of M. T. Pont." [R. G.]. A map of the west coast from Loch Broom southwards to Loch Alsh. There is much neat detail, but the map is very imperfect; Loch Torridon is not shown at all. (1) $14\frac{1}{2} \times 8$. (2) 13×8 . (3) 3. (4) c. 6.

15. End: "Loch Lung and Loch Dowi . . ." [R. G.]; the rest of the name has been cut away. The map includes all the Lochs opening into Loch Alsh. There is little detail; the work is in neat print. (1) $6\frac{1}{2} \times 7\frac{1}{2}$. (2) $6\frac{1}{2} \times 7$. (3) $2\frac{1}{4}$. (4) c. 4.

16. Title, "A draught of the Firths of Tayne, Cromartie, & Inverness, wt ye true distances as yey do ly." [J. G.]. The map is mainly coast-line, with most of Loch Shin. There is little detail. The work is small neat print and script. (1) 11×12 . (2) 10×10 . (3) $3\frac{3}{8}$. (4) c. 5.

17. Map of the coast at the head of the Moray Firth, showing Dornoch, Cromarty, and Beaully Firths. Only general detail on the coast; some parts of river courses are shown. The work is neat print. (1) $7\frac{1}{2} \times 12\frac{1}{4}$. (2) $7\frac{1}{2} \times 10$. (3) ——. (4) 6.

18. End: "Part of Ros." [? R. G.]. Map of Moray Firth and its inlets, with detail between Tain and Inverness, and the northern half of Loch Ness. The Beaully Firth has been drawn twice, but the second drawing is less good than the first. In the top right-hand corner is a small inset of the Ord of Caithness. The coast-line is strengthened by fine horizontal shading. The work is neat small print. (1) $23 \times 15\frac{1}{2}$. (2) $22 \times 15\frac{1}{2}$. (3) 2. (4) 2.

19. Title, "The draught of ye river of Charron whiche falleth into the head of the firth of Tayne in Ros. from Mr. T. Pont's papers." [R. G.]. End: "Stra-Charron." [? R. G.]. The work is very neat and fine. (1) 12×16 . (2) $8 \times 14\frac{1}{2}$. (3) c. 2. (4) c. $1\frac{1}{2}$.

On the back there is a long table of distances in James Gordon's script. There is also this note in Sir Robert Sibbald's script, "In ys bundle 1. The Draught of ye River of Charron yt falleth into ye Firth of Taine. 2. Ye mapp of Coygach. 3. a Mapp of Cathness with which

is a paper containing the interpretation of severall Irish words. 4. Mapp of Sutherland, Strackel & Stracharron. 5. Ye mapp of Coygach & Lochbryin. 6. Ye Mapp of Assin by T. P. 7. Ye Mapp of Eddra-cheules by T. P. 8. Mapp of Lochness & ye Land lying upon ye head yrof. 9. Ye mapp of ye West Isles by T. P."

20. Title, "Rosse." [R.S.]. A map of the peninsula between the Firths of Cromarty and Tain. The work is neat print, slightly faded. The sheet is incompletely ruled. The names read from the east. (1) $9 \times 9\frac{1}{2}$. (2) $9 \times 9\frac{1}{2}$. (3) —. (4) $1\frac{1}{2}$.

21. A map of the district from Loch Monar to Beaully and Strath Bran. An extremely confused and inaccurate map. Loch Fannich is twice misplaced and cancelled, and the third placing is wrong. The work is faded neat print. (1) $8 \times 12\frac{1}{4}$. (2) $8 \times 12\frac{1}{4}$. (3) 3. (4) 3.

22. Map of River Findhorn down to just below the junction of the Fintack Burn. The work is fairly neat, in black ink over pencil. (1) $12\frac{1}{4} \times 8$. (2) $12\frac{1}{4} \times 7\frac{1}{4}$. (3) $1\frac{1}{4}$. (4) c. 2.

23. Title, "Murray." [?R.S.]. End: "Murray. M.T.P." [R.G.]. A map of the district from Elgin and Loch Spynie to beyond the River Spey. There is much detail in fair print. (1) $6 \times 9\frac{1}{2}$. (2) $6 \times 9\frac{1}{4}$. (3) —. (4) c. 3.

24. Map of the River Avon down almost to its junction with the Spey; it includes Lochs Avon and Builg, and the headwaters of Don and Nethy. There is much detail, in fine neat print. The map has been irregularly cut out of a larger sheet. (1) $8 \times 10\frac{1}{4}$. (2) 8×10 . (3) —. (4) c. 3.

25. End: "Aberdeen, Banf, Murrey &c. to Invernes." [R.G.], and "Fra the north water to Ross." [?R.G.]. A very detailed and beautiful map of Aberdeen and the Mearns, and the country to the west, including Glen More and the upper part of Loch Linnhe. "Robertus Gordonius a Strathloch describebat 1640." [R.G.]. The mapping round the head of Loch Leven is cancelled. The work is in beautiful fine print. (1) 21×27 . (2) 14×26 . (3) 6. (4) 6.

26. Title, "Strathbogie and Ainzie." [R.S.]. End: "Strathbogie and Aenzie. R.G." [R.G.]. A detailed map including the Rivers Bogie, Deveron above the junction of Isla, Eddich, and Spey below the junction of Eddich, and the coast from Speymouth to Fordyce. The work is very neat print. There are three scales given, at top and at bottom 1 in. = $\frac{5}{8}$ mile, and also "Scala miliarium contractorum," 1 in. = $2\frac{1}{2}$ miles. In each of the larger scales the numbering starts from 1. (1) $26\frac{1}{2} \times 15\frac{1}{4}$. (2) 26×15 . (3) $\frac{5}{8}$ and $2\frac{1}{2}$. (4) c. $1\frac{1}{4}$.

27. End: "Strath Done." [R.G.]. A detailed map of the river Don down to just below the junction of the Sui Burn. The source of the river is drawn on a separate paper, pasted in the north-east corner of the map. Some of the work is in neat clear print, but some is less neat and clear. There are some tables of distances in James Gordon's script. (1) $12 \times 18\frac{1}{4}$. (2) $12 \times 15\frac{1}{2}$. (3) $1\frac{1}{2}$. (4) $1\frac{1}{2}$.

28. This sheet carries two maps. (1) $18\frac{1}{2} \times 22\frac{1}{2}$.

A. End: "Marre from Kincairne Pueill to the Springis of Dee. R. G." [R. G.], and "Brae of Marr or Strath Dee." [R. G.]. A detailed map showing the Dee from its source to just below Kincharn. It includes also the Don from its source to Monimusk, the Bogie to just below Rothiemay, the Feshie to its junction with the Spey, the Spey between Ruthven and Kinrara, and the headwaters of Tilt and Tarff. It shows many mountains and much woodland. The work is in neat fine print. The names read from the north. The sheet is ruled with a stylus in squares of about $\frac{1}{2}$ inch sides. The scale is given on the sides of the map, and the numbering is curious; latitudinally the numbers run both ways from 1, not 0, to 22 in the north and to 9 in the south; and longitudinally they run from 18 in the east to 58 in the west. The sheet is made up of several pieces, and there is a patch near the mouth of the Muick. (2) $17\frac{1}{2} \times 21\frac{1}{2}$. (3) 2. (4) c. $2\frac{1}{2}$.

B. Title, "The Draught of Dee River fra Kincairne to Durris." [R. G.]. A detailed map extending in the north to "Craginhie" and the Hill of "Fair," and in the south to "Cloch na Pin." The work is in neat fine print. This map is pasted in the north-west part of the preceding map. (2) 6×12 . (3) $1\frac{1}{5}$. (4) $1\frac{1}{2}$.

29. Title, "Part of Birss." [R. G.]. End: "Part of Birss." [R. S.]. A map of the River Dee from Birss down to Innerchat, showing in detail the district on the north side of the river. The work is in neat print. The map shows Loch Achlossin, which no longer exists. (1) 6×8 . (2) 6×8 . (3) $\frac{3}{4}$. (4) c. $\frac{3}{4}$.

30. Title, "The draughte of the Birs wt. the nixt parts of the river Dee." [R. G.]. A map of the river Dee between Glentanar Kirk and Crathes, with the country on either side, and especially most of the Feugh valley. There is very fair detail, in very neat print. (1) $7\frac{3}{4} \times 12$. (2) $7\frac{3}{4} \times 12$. (3) $1\frac{1}{4}$. (4) $1\frac{1}{4}$.

31. A map of the district along the north side of the River Dee near Crathes and Durris, showing "Ye Lyne of Leys possession" and "Lyne of Leys clayme." The scale is very uneven. (1) $12 \times 14\frac{3}{4}$. (2) $12 \times 14\frac{1}{2}$. (3) —. (4) $\frac{1}{2}$ to $\frac{1}{3}$.

32. End: "Formarten and part of Marr and Buquhan observed R. G." [R. G.]. A large and detailed map of River Don, lower part of Ythan and Dee, and small part of Bogie. The work is very neat print. The sheet is irregularly ruled in pencil squares, some about $1\frac{1}{2}$ inch sides, and some $\frac{1}{2}$ inch. The paper has been much patched and mended; the mapping of Bennachie is on a patch. For convenience in re-binding, the small outstanding piece of Strathbogie has been moved from its normal position. (1) 32×36 . (2) $31\frac{1}{4} \times 36$. (3) —. (4) c. $1\frac{1}{4}$.

33. Title, "Lower part of Bu . . ." [? R. S.]. The rest of the word has been cut away. End: "Lower Part of Buquhan." [R. G.], and "Laich of Buquhan." [R. G.]. The map has much detail; and shows the coast from Boddam round to just west of Troup Head, and part of the Ythan near Gight Castle. The work is in Robert Gordon's neat print, with

corrections in darker ink in James Gordon's more cursive script. The sheet is ruled from west to east at $\frac{3}{4}$ inch intervals. (1) 12×16 . (2) $11\frac{3}{4} \times 15$. (3) $1\frac{1}{4}$. (4) $1\frac{3}{8}$.

34. Title, "Part of Aberdeen Shyre." [R. S.]. End: "Buchan." [R. G.]. A detailed map of the coast from the Ythan to the Ugie, and the country inland to their sources. The coast is continued in pencil round to Pitsligo. The work is in neat print. The sheet is ruled with a stylus into squares of $\frac{1}{2}$ inch sides. (1) $21 \times 17\frac{1}{2}$. (2) 20×17 . (3) $1\frac{1}{2}$. (4) c. $1\frac{1}{2}$.

35. A map of the coast from the Ythan to Inverugie. There is fair detail along the "Croudan" River and the Fervie Burn, but little elsewhere. The work is in large good print. The name "Buquhan Ness prō" is applied to the headland on the north side of Peterhead Bay. (1) 13×12 . (2) $12\frac{1}{2} \times 12$. (3) —. (4) $\frac{4}{5}$.

36. Title, "Lochabyre." [R. S.]. End: "Lochabre. R. G." [R. G.]. The map includes Glen More with its three lochs, and the River Spean with Loch Laggan, in ink, and Lochs Garry and Arkaig in pencil. The district to the north of Loch Leven has most detail, but there are some serious inaccuracies. The work is in neat print. (1) $12\frac{1}{2} \times 11\frac{1}{2}$. (2) $12 \times 11\frac{1}{4}$. (3) 5. (4) $4\frac{1}{2}$.

37. End: "Lochabre Glencooen. R. G." [R. G.]. A fairly detailed map of the district round the north and east of Loch Linnhe, including Lochs Lochy and Oich. The work is fairly neat print. (1) 15×14 . (2) $13\frac{1}{2} \times 13\frac{1}{2}$. (3) 2. (4) 2.

On the back there is very rough mapping of the rivers and lochs of the same district.

38. Title, "Map of Lochaber." [R. S.]. End: "Lochabyr." [R. G.]. Shows lochs and rivers connected with the inner part of Loch Linnhe, the head streams and lochs of the Tummel, the south part of Loch Ness, and Lochs Oich and Garry. There is moderate detail, the work being neat print. (1) 12×16 . (2) $12 \times 15\frac{1}{2}$. (3) 4. (4) c. 4.

39. End: "Cantyr." [R. G.]. Map of Cantyre southwards from Tarbert. There is much detail in small neat print. (1) $8\frac{3}{4} \times 4\frac{3}{4}$. (2) $8 \times 4\frac{1}{2}$. (3) 5. (4) 5.

40. Title, "Athol . . . and Renna . . ." [R. G.]; the title is broken away at the torn edge of the paper. End: "Atholl Rennach wt. all the bordering waists." [? J. G.]. A map of central Scotland, from upper Spey to Loch Tay, and from Spean Bridge and Roy to Braemar and Logie-rail. It is mainly a map of mountains, rivers, and lochs, and shows these in very fair detail. The work was first done in pencil, and has many corrections. The ink work is mostly in very neat print, but some of the corrections are a little rough. There is also some work in faded ink, especially about Loch Rannoch. There is a large patch, including Glen Lyon and Loch Tay. (1) $12 \times 14\frac{1}{2}$. (2) 12×14 . (3) $3\frac{1}{2}$. (4) 3 to 4.

41. End: "Anguss. R. G." [R. G.]. A map of the River Tay and its tributaries from Strowan and Weems to St. Andrews. Mainly the names are only along the rivers, but there is fair detail near Dundee. The work is in good script. (1) $15\frac{1}{2} \times 22\frac{3}{4}$. (2) $15 \times 22\frac{1}{2}$. (3) $2\frac{1}{2}$. (4) c. 3.

On the back there is mapping of the country from Loch Tay to Braemar.

42. End: "Brae of Angus." [R. G.], and "The height of Anguss. M. T. P." [R. G.]. A detailed map of the Forfarshire rivers, from Clova in the east to Isla in the west, and from the watershed in the north to the "K. of Tannadis" and the sources of the southern tributaries of the Isla in the south. The Isla is shown to just beyond Coupar Grange. The work is in fine neat print. (1) $15\frac{1}{2} \times 14$. (2) $15\frac{1}{2} \times 14$. (3) $1\frac{1}{2}$. (4) 2.

43. End: "Glen Yla, Glen Ardle, Glen Shye, out of Mr. T. Pont's papers yey ar very imperfyt." [R. G.]. There is much detail round the upper part of the Isla, but mere outline in the lower part. The work is fine neat print. A note states, "It is 4 myl of month betuix ye head of Glen Haitnach and Innerey in Braemar."

44. Map of North Esk River. The work is fine neat print. (1) $12 \times 9\frac{1}{2}$. (2) 9×9 . (3) —. (4) $2\frac{1}{2}$ to $3\frac{1}{2}$.

45. End: "Mernis." [R. G.]. An outline map of the coast from Aberdeen to Montrose, and the district inland. The lower part of the Dee is shown, and the whole of the North Esk; there are no hills, and but few names. The work is in very neat print. (1) $14\frac{1}{2} \times 21\frac{1}{2}$. (2) $14 \times 17\frac{1}{2}$. (3) $1\frac{3}{5}$. (4) c. 2.

46. An outline map of the Firth of Tay and the coast to Fife-ness. There are few names, in very neat print. In pencil the river course is continued up to the junction of the Earn. (1) $6\frac{1}{2} \times 15\frac{3}{4}$. (2) $6\frac{1}{4} \times 15$. (3) —. (4) 2.

47. An outline map of the Tay estuary round to Fife Ness, continued in pencil to Leven, and thence in ink to Kirkcaldy. There is some detail in Fife. The work is in neat print. (1) $7\frac{1}{2} \times 12$. (2) 7×10 . (3) 3. (4) 4.

48. End: "Loch Lomond &c." [R. G.]. A map of central Scotland, from the River Tummel to Glasgow, and from Loch Long to Broughty Ferry. There is detail on the shores of the Firths of Tay and Forth, near Loch Lomond, and between Loch Lomond and Glasgow; the rest is in pencil outline. The work is in very neat print. The paper is patched. (1) $18\frac{1}{2} \times 25\frac{1}{2}$. (2) 18×25 . (3) 3. (4) 3.

49. End: "Lennox Argyle." [R. G.]. The map includes the River Forth down to Stirling, the River Clyde below Glasgow, Loch Lomond, Gare Loch, Loch Long, Bute and the Kyles, and part of Cantire. The Gare Loch is drawn twice; one drawing is cancelled, and the corrected drawing is not joined up to Loch Long. There is much detail in neat print near Loch Lomond; the rest is in mere outline. (1) $12\frac{1}{4} \times 18\frac{3}{4}$. (2) $9\frac{1}{2} \times 18\frac{1}{2}$. (3) 5. (4) 5 to 6.

50. End: "Sterlinshyr & Lennox." [R. G.], and "Sterlingshyre, wt. a part of the Lennox, and sum of Clydsdaill." [R. G.]. A map of central Scotland, from the Clyde below Dumbarton to the Forth at Saltcoats, and from Stirling to the Clyde above the Kelvin. There is much detail in very fine neat print. A note, in James Gordon's script, gives some directions and distances. (1) $12\frac{1}{2} \times 16$. (2) $12\frac{1}{4} \times 16$. (3) —. (4) c. 3.

51. A map of the basin of the River Forth, down to the opening of the estuary near Alloa. The Bridge of Doun is drawn three times, two of them cancelled. The names read from the east. The work is neat, partly print and partly script. (1) $8 \times 12\frac{1}{2}$. (2) $8 \times 12\frac{1}{4}$. (3) $2\frac{3}{4}$. (4) $2\frac{1}{2}$.

52. Title, "Keanrosse-shyre descrybed Oct. 25, 1642. Be Ja. Gordon, at Keanrosse." [J. G.]. A sketch map in fairly neat script over pencil, the rivers only sketchily drawn. The scale given starts from 1. (1) $8\frac{3}{4} \times 14$. (2) $7\frac{1}{2} \times 14$. (3) 1. (4) $1\frac{1}{2}$.

53. Title, "Fyfe Shyre MDCXLII. Fifa Provincia Noviter delineata Auctore Jacobo Gordonio Fo. R. G. a Strathloch." [J. G.]. A beautifully finished and detailed map of Fife, with inset in north-west of St. Andrews, and in south-east of Cupar Fife. (1) $17\frac{1}{4} \times 21\frac{1}{2}$. (2) $15\frac{3}{4} \times 20\frac{1}{4}$. (3) 2. (4) c. $2\frac{1}{2}$.

54. This sheet carries two maps. (1) $11\frac{1}{4} \times 14\frac{1}{2}$.

A. End: "Fyffe imperfect. M. T. P." [R. G.]. A fairly detailed map of north Fife. The work is in neat print. A river is drawn from Falkland to Shells, and along it is written, "There is no river betwixt Shells and Falkland." Cupar Fife and Dundee are shown in the map, but are not named. There is a note in Robert Gordon's script of the defect of the map near Abernethy. (2) $10\frac{1}{2} \times 14\frac{1}{2}$. (3) —. (4) $1\frac{1}{2}$.

B. Title, "Pt of the Par. of Abyrnathy." A small map to correct the fault noticed in the previous map, and pasted in its bottom left-hand corner. The work is in somewhat faded neat print. By its side, on the larger sheet, is a note in Robert Gordon's script, "Rien est droit en cestui Table." (2) $5\frac{3}{4} \times 3$. (3) —. (4) 3.

55. Title, "Barony of Ranfrew." [R. S.]. A map of the district from the Clyde estuary southwards to Flatterstoun. It includes in the north "Dumbritton," and in the south the sources of the Cart and the Calder. The south part of the map is without names. The work is in small neat print. (1) $15\frac{1}{4} \times 22$. (2) $13\frac{1}{2} \times 21\frac{1}{4}$. (3) —. (4) c. 2.

56. A map of the Clyde and Tweed basins. The Clyde is merely in outline, with few tributaries, and but five place-names; the Tweed is in great detail as far down as "Carhoome," just below Kelso. (1) $12\frac{1}{2} \times 14\frac{1}{4}$. (2) $12 \times 13\frac{1}{2}$. (3) 5. (4) c. $5\frac{1}{2}$.

57. Title, "The Sherifdome of Etricke Forrest with the adjoining provinces." [R. G.]. End: "Etterik Forrest wt ye joyning provinces." [R. G.]. A fairly detailed map of the River Tweed down to Coldstream, with the Ettrick and the Teviot. The work is in very neat print. (1) 8×12 . (2) 8×12 . (3) 4. (4) c. $4\frac{3}{4}$.

58. Title, "A description of the province of the Merche." [R. G.]. End: "The Mers." [R. G.]. A detailed map of the district between the Firth of Forth and the Tweed, and inland from the coast to Selkirk. The work is in fine neat print. (1) 11×12 . (2) $10\frac{3}{4} \times 11$. (3) $2\frac{1}{2}$. (4) $3\frac{1}{2}$.

59. End: "Cunningham." [R. G.]. A map of the district from the Clyde estuary southwards to Irvine. No hills are shown, and there is little detail. There is a duplicate drawing of Lochs "Whinnoch," *i.e.* Semple, and Kilburnin. The work is partly in neat print, and partly in moderate script. (1) $9\frac{1}{4} \times 7\frac{1}{2}$. (2) $8\frac{1}{2} \times 6$. (3) 3. (4) c. 4.

60. End: "Cunningham." [R. G.]. An outline map of south-west Scotland from Irvine round to the head of Solway. The southern two-thirds of Ayrshire, *i.e.* the part that is *not* Cunningham, has much detail in small neat print. (1) $14\frac{1}{2} \times 16\frac{1}{4}$. (2) $12\frac{1}{2} \times 15\frac{1}{2}$. (3) 5. (4) 3.

61. A map of the coast from Loch Ryan nearly to the head of Solway. The eastern half is little more than outline; the western half has much detail, in small neat print. (1) $7\frac{1}{2} \times 14\frac{3}{4}$. (2) $6 \times 14\frac{1}{2}$. (3) 5. (4) 5.

62. Title, "Nithsdail, descryved according to Mr. Timothe Pont his papers be R. Gordon, 1644, Mense Maie." [R. G.]. End: "Nithisdail." [R. G.]. The sheet has been ruled with a sharp stylus from top to bottom at $\frac{1}{4}$ inch intervals. The work is detailed, in small neat print. (1) $12 \times 12\frac{1}{4}$. (2) $11\frac{1}{4} \times 11$. (3) 4. (4) $4\frac{1}{2}$.

63. End: "Sulway fyrrh Liddesdale Es . . ." [R. G.]. A map of the head of the Solway Firth, with Annandale, Eskdale, Liddesdale, and the Carlisle district. There is fair detail except in Annandale. The work is in neat print. (1) 12×12 . (2) 11×12 . (3) 3. (4) $3\frac{1}{2}$.

64. A small map of Eskdale and Liddesdale, with much detail in fine neat print. (1) 11×14 . (2) $7 \times 11\frac{1}{2}$. (3) 5. (4) c. 7.

MANUSCRIPT MAPS BY JOHN ADAIR.

1. Title, "The Mappe of Orkney, with the harbours and Islands, anno 1682." The sheet is irregularly ruled into rectangles, and there is a set of radiants from the centre of the sheet. The west is at the top of the map, and the names read from the east. (1) $28\frac{1}{4} \times 23\frac{3}{4}$. (2) $23\frac{3}{4} \times 18$. (3) c. $2\frac{1}{2}$. (4) $2\frac{1}{2}$.

2. Title, "The Mappe of Straithern, Stormont, & Cars of Gaurie, with the rivers Tay & Ern, surveighed & designed . . . John Adair Math: anno 1683." The hills are in wash; the other work is rather faded. There is a set of radiant pencil lines from Perth. (1) $22\frac{3}{8} \times 28$. (2) $17\frac{3}{4} \times 26\frac{1}{2}$. (3) $1\frac{1}{3}$. (4) 2.

3. Title, "A Mape of the countries about Stirling, authore Jo. Adair." The hills are in wash. The sheet is ruled in squares of $1\frac{1}{2}$ inch sides, and these are numbered in the margins. (1) $22\frac{3}{4} \times 27\frac{3}{4}$. (2) $19 \times 21\frac{3}{4}$. (3) $\frac{2}{3}$. (4) c. 1.

4. Title, "The Hydrographical mappe of Forth from the entry to ye Quensferry, authore Jo. Adair." The hills are in wash; detail is mainly on coast. The sheet is irregularly ruled with squares both correctly orientated and oblique, and with numerous radiating lines. There are little inset views of islands and headlands. The coast has been gone over with a sharp stylus, as if for tracing. (1) $22\frac{1}{2} \times 27$. (2) $18\frac{1}{4} \times 25\frac{1}{2}$. (3) $1\frac{7}{8}$. (4) 2.

5. A map of Strath Devon and the district between the Ochils and the Forth. The hills are shaded with a wash, and are outlined in red ink. (1) $14\frac{3}{4} \times 20\frac{1}{2}$. (2) $14 \times 19\frac{1}{2}$. (3) $\frac{1}{2}$. (4) Uneven, and much less than given.

6. Title, "A Mapp of Clakmanan Shire." This is a "proof" of the same map printed from an engraved plate. The hills are shaded with hachures. (1) 14×20 . (2) $14 \times 19\frac{1}{2}$. (3) $\frac{1}{2}$. (4) Uneven, and much less than given.

7. Title, "The East Part of Fife surveyed & designed be John Adair Math. 1684." The hills are in wash; most of the other work is much faded. The sheet is ruled in squares of $1\frac{1}{2}$ inch sides. (1) $22\frac{1}{2} \times 28$. (2) 21×26 . (3) $\frac{2}{3}$. (4) c. 1.

8. Title, "Mappe of Wast Lothian comonly called Linlithgowshire. authore Johanne Adair." The hills are in wash; some of the work is in Adair's neat style, rather faded, but some of it is untidy, in a brown faded ink. The sheet is ruled in squares of $1\frac{7}{8}$ inch sides, and some of these are subdivided into sixteen squares each. (1) $22\frac{1}{2} \times 27\frac{1}{4}$. (2) $18\frac{3}{4} \times 23\frac{1}{4}$. (3) $\frac{3}{8}$. (4) c. 1.

9. Map of Midlothian. The hills are in wash; the other work is slightly faded. The sheet is ruled in squares of $1\frac{5}{8}$ inch sides, and these are numbered in the margins. (1) 24×32 . (2) 23×32 . (3) —. (4) 1.

10. Title, "East Lothian. authore Johanne Adair Math: Anno. 1682." The hills are in wash; the other work is slightly faded. The sheet is ruled in squares of $1\frac{1}{8}$ inch sides, and these are numbered in the margins. Another set of similar squares, ruled obliquely on the sheet in red ink, gives the proper orientation. (1) $22\frac{3}{4} \times 27\frac{3}{4}$. (2) $19\frac{1}{4} \times 21\frac{1}{2}$. (3) $\frac{5}{8}$. (4) $\frac{5}{8}$.

11. Title, "A mappe of the wast of Scotland containing Clydsdail, Nithsdail, Ranfrew, Shyre of Ayre, & Galloway. authore Jo: Adair." The hills are in wash; the other work is somewhat faded. The sheet is ruled in squares of 1 inch sides, and these are numbered in the margins. (1) $22\frac{1}{2} \times 27\frac{1}{4}$. (2) 17×19 . (3) 4. (4) c. 5.

12. Title, "The Sherifdome of Etrik Forest." A map of the district between the River Tweed and the Borthwick Water. The hills are in wash; the other work has somewhat faded. The sheet is ruled in squares of $\frac{7}{8}$ inch sides. (1) $22\frac{3}{4} \times 27\frac{3}{4}$. (2) 22×19 . (3) $1\frac{1}{4}$. (4) c. $1\frac{1}{4}$.

THE LEICESTER MEETING OF THE BRITISH ASSOCIATION.

THE British Association met at Leicester on July 31 and the following days, under the Presidency of Sir David Gill. As already stated, Section E (Geography) was presided over by Mr. Chisholm, whose address we published last month. The other papers may be grouped under headings according to the countries to which they refer.

Regional Survey work in Europe was represented by three papers—one on the Land's End Peninsula by Mr. A. W. Andrews, one on the district of Jaederen in Southern Norway by Mr. O. J. R. Howarth, and one on the Hinterland of the Port of Manchester, by Mr. J. Macfarlane. An abstract of Mr. Andrews' paper follows:—

The Land's End peninsula consists of a granite plateau, of which the higher part is from four hundred to eight hundred feet in elevation and about eleven miles in length by four in width, extending in a south-westerly direction from St. Ives to the Land's End. This largely consists of moorland covered with furze and heather, but almost entirely bare of trees, owing to its wind-swept character. The hills which rise from the plateau are generally undulating, and only here and there assume bold shapes, though they are crowned by masses of granite boulders, many of which are not inferior in size to the tors on Dartmoor.

The whole area is almost unpopulated and has few industries, though the old mine shafts and adits made for prospecting purposes point to much greater activity in former days. Almost the only industries which now exist are connected with the granite, a small amount of the fine-grained moorland granite being quarried, though it cannot hold its own against the cheaper sea-borne Norwegian stone. There are also china-clay works, as at Towednack. It is possible that the modern demand for tin, wolfram, and other rare minerals may result in some of the old mines being reworked, but as yet very little has been done on the plateau.

To the north and west of the plateau is a narrow coast plain, of less than a mile in width, which was probably covered by the sea in Pliocene times to the height of 340 feet. This is employed for agricultural and pastoral pursuits, but the soil is poor and unproductive. The valleys which seam the plateau on these sides are not well marked, and the streams are small. The coast is, as a rule, lofty, with striking granite and greenstone cliffs, and is almost harbourless, few coves being accessible for even small fishing-boats. The only important centre of population is in the neighbourhood of St. Just, where the Levant mine and that newly reopened at Botallack employ a considerable number of miners. On the south of the higher plateau the streams are longer and the valleys deeper, many of them being thickly wooded. The soil is much richer, especially near Penzance, where the greenstone predominates, and where industries such as the cultivation of cauliflowers are of considerable importance, land being let at from £12 to £14 per acre. The climate is far warmer and milder, the region being largely sheltered from winds.

The whole peninsula is separated from the rest of Cornwall by a neck of low land. Though small, it has sufficient characteristic features to mark it off from the rest of Cornwall, and is specially interesting as a type of a somewhat isolated area of old rock, in that respect resembling the inland region of Charnwood Forest.

Mr. Howarth's paper, which was read after the President's address, is officially summarised as follows :—

The district of Jaederen extends south of the port of Stavanger, on the Birkren Fjord. South of this fjord is the principal of the few interruptions to the *skjaergaard*, or great fence of islands which protects practically the whole coast of Norway. At first this coast is unbroken, low, and shingly, backed by a slightly undulating coastal belt, bare and abounding in peat bogs, from the landward edge of which hills rise abruptly. There then succeeds a coast with rocky prominences alternating with sandy beach, and still practically without islands, which extends nearly to the port of Egersund, when the characteristic steep, broken coast, with many islands (though not so many as to the north of Stavanger), is resumed. This intermediate stretch of coast belongs to a peculiar region, which is defined inland by a sharp range of mountains to the north, and by mountains and the valley of the Birkren River to the east. Beyond these boundaries is found the typical scenery of Southern Norway; within them the scenery is wholly individual in character. The district is still hilly but less elevated, the hills rise in semi-isolated clumps, and the whole is practically an unbroken tract of naked rock, which reveals, to an extent dominating every other feature, and scarcely equalled elsewhere in this intensely glaciated country, the work of the glacier which once covered it. The perched blocks scattered all over it, the innumerable hollows carrying little lakes, and the remarkable manner in which at many points huge boulders are piled together and riven, all illustrate the action of the same force. Moreover, the coast of this district demonstrates peculiarly well the upward movement of the land which is traceable elsewhere. A succession of lowlands separated by high ridges indicates former small fjords; an old beach may be traced at a considerable distance inland; and through the sand-dunes and marshes along the shore high rocky eminences stand up, clearly once islands. But the rocks immediately upon the coast show that at the period of glaciation the land stood higher than it does now, and thus indicate an intermediate period of sinking. The diverse physical characteristics of Jaederen exercise a notable effect on the distribution of its population.

Mr. Macfarlane's paper dealt with the limits of the area served by the Port of Manchester, and the character of the trade carried on.

The Kurdish Tribes of Asiatic Turkey formed the subject of a communication by Mr. Mark Sykes, who emphasised the great variations in the tribes included under this designation. The main points of this paper may be gathered from the following abstract :—

From Uruma, in Persia, to Angora, in Asia Minor, there is scattered a nation or a group of people who have suffered considerable neglect at the hands of history and science alike. These are the Kurds—nomadic, semi-nomadic, and sedentary. Except that they are credited with a multitude of imaginary vices and are looked on as ignorant savages, they receive but little attention from the people either of Asia or of Europe. Fortune has enabled the author to make certain investigations concerning these people, among whom he finds such startling variety in physique, dress, and custom that he is unable to generalise on their characteristics, save in a very diffident manner. He has distinguished and marked on the map about 323 tribes and sub-tribes, which at a venture may be said to contain a population of close on 2,000,000.

It is very difficult to say how the Kurds should be classified. As regards

religion there are to be found among them Sunni Moslems, Shias, Devil-worshippers, Pagans, and Christians. As to language they are split up into a variety of dialects, which are said to form two broad divisions, called respectively Zaza and Kermanji. In regard to appearance and physique there are, again, the most unexpected and astounding contrasts; small, wiry, agile mountaineers in Hakkari; tall, slim horsemen in Irak; big-boned, heavily built, hook-nosed, and clumsy men north of Lake Van; stout, full-bearded men with regular features in North Mesopotamia; fair-haired and ruddy-complexioned men north and west of Erzinjan; and straight-featured, exceedingly handsome men in Kochkiri.

In respect of civilisation and mode of life we again find surprising contrasts. In Irak the Kurds are generally shepherds, but in the northern mountains south of Lake Van they are industrious agriculturists, some of whom build fine houses and castles. North of Lake Van they are idle; in the Dersim they are more than industrious; in Mesopotamia they are wholly nomads; in the western Taurus they are often degraded and poverty-stricken; in the valley of Erzinjan they are capable and wealthy agriculturists.

Mr. H. T. Ferrar exhibited an outline map of the northern part of the Etbai desert in Egypt, prepared in order to bring out the main physical features of the country. The following points illustrated by this map are worthy of note:—

1. *Basins*.—Floyer has drawn attention to the fact that the wadis draining westward from the water-parting are centripetal. The map shows three of these basins, viz., Qena, Edfu, and Kom Ombo.

2. *Beheading*.—As in South Africa, so here the gentler sloping western wadis have been beheaded by the steeper eastern ones, *e.g.* Rod Um el Farag by Wadi Dabur; Wadi Zeidum by Wadi Dubbagh.

3. *Mushels*, *i.e.* the forking or branching of wadis owing to the aggraded state of their beds, *e.g.* Wadi Abu Hamamid, Rod el Moghalat; and more especially Wadi Hendosa and Wadi Abu Tiur, which have the same source.

4. *Arabic geographical terms*, such as Gebel, Wadi, Rod, Kob, Talla, Khor, Sowahil, Dahariah, Ghradir, Galt, Bir.

5. *The history of the region*, with special reference to (a) the Nubian Sandstone escarpment; (b) the age of the drainage system; (c) indications of a former pluvial period; (d) high-level gravels and alluvium; (e) the wide distribution of celts.

Other papers dealing directly or indirectly with Africa included an account by Mr. R. B. Woosnam of the Ruwenzori expedition in which he took part, together with a description of the plant zones on the mountain. Reference has been already made here both to the expedition generally and to the zones of vegetation (*cf.* page 546). Captain Behrens read a paper on the Modern Explorer which referred especially to recent survey work in East Africa and Uganda, and Major Close one on the Surveys of British Africa, a subject which has been treated of elsewhere in this *Magazine* in a Note (p. 600).

Among the papers dealing with America may be noted an account of the Jamaica earthquake by Dr. Vaughan Cornish. The paper was of the nature of a preliminary account, for Dr. Cornish is to present a full account of his results to the Royal Geographical Society at a later date.

Mrs. Leonidas Hubbard, jr., gave an account of a Traverse of Two Unexplored Rivers of Labrador, which is summarised below :—

The journey across the north-eastern portion of the peninsula by way of the Nascaupsee and George Rivers was undertaken by Mrs. Hubbard for the purpose of completing the mission of exploration which in 1903 had cost Leonidas Hubbard, jr., his life. She left North-west River Post, near the head of Lake Melville or Grosswater Bay, on June 27, 1905. The first task was the tracing of the Nascaupsee River to its source. The river descends from its source at the height of 1675 ft. above the sea by what may be termed a series of steps.

Five weeks of struggle with the rapids found the party encamped on August 2 on the shores of Lake Michikaman, a great interior lake ; and on August 10 the final source of the Nascaupsee River on the Height of Land was reached.

The source of the George River was located immediately beyond the Height of Land in Lake Hubbard. It is a tiny stream as it first steals away northward ; but in the 300 miles of its course it gathers force and volume till at its discharge into Ungava Bay it is a great river 3 miles in width. The upper part of each of the rivers consists of a series of lake expansions of varying sizes. Some 60 miles from its source the George River drops from the plain of the lakes through three narrow gorges, and flows in a distinct valley.

The most thrilling part of the journey was the descent of the last 132 miles of the George River, where it flows in almost continuous rapids through country becoming more and more mountainous, rugged, and barren, till in the last 50 miles the banks become gradually lower as the river nears the sea. The journey of about 600 miles was made in sixty-one days, the party arriving at the Hudson Bay Company's Post near Ungava Bay on August 27.

Other papers dealing with American subjects were those by Professor Spencer and Mr. M. Allorge. Professor Spencer gave an account of the results of his work on the Recession of Niagara Falls, of which mention is made in our June issue (p. 318), and Mr. Allorge described the recently discovered cave of Atoyac, in Mexico, with special reference to the relation between the passages and chambers and the structural planes of the limestone.

Under Australasia may be noted a short account given by Dr. W. M. Strong, of British New Guinea, which dealt both with the physical features and with the economic geography.

A very interesting general paper was that by Professor Vidal de la Blache on the "Geographical Evolution of Communications," a subject upon which we have published several notes recently. Professor de la Blache pointed out that man had originally no other means of travel and transport than himself. But, whether for the purpose of adjusting or hauling loads, of surmounting obstacles, or of venturing on the water, he has had recourse to devices the invention of which points to varying environments and a multitude of independent initiatives, the local flora and fauna furnishing the material for this primitive apparatus. A great step in advance was made in the adaptation of animal power to purposes of transport, and this ensured the superiority of such countries as afforded the opportunity for the recruitment by man of his best auxiliaries. This kind of domestication had its origin at many different centres. The horse was doubtless brought under man's control independently in many

countries of Central Europe and Asia; the camel, in Central Asia; the ass, in the Soudan, Upper Egypt, etc. The vast region of plains or steppes, with bare uniform surface, which crosses Europe and Asia in a diagonal direction, favoured the development of long-distance traffic, as is proved by the numerous improvements in the wheel and cart which were there introduced. But this ancient transport had to do rather with human beings than with dead freight. To the domestication of the horse we may attribute the origin of the great migrations which took place in Central Europe from the close of the Neolithic Period onwards, and which were destined to cease only with the definite crystallisation of modern States. Even the interior traffic of later times originated in the movement of distant products, such as jade, silk, and certain metals.

A short afternoon lecture by Mr. J. D. Rogers dealt with Explorers and Colonists, and traced the various motives which have led men to engage in exploration.

Professor Max Eckert read a paper on the subject of "Commercial Geography," which is published in the present issue (p. 561).

In a joint meeting with Sections C (Geology) and K (Botany) Professor Conwentz of Dantzic read a paper on the "Preservation of Natural Monuments." He explained that the phrase "natural monuments" was new in Germany as well as in England, but it should be recognised that there can be monuments of nature as well as of art: The constant inroads of cultivation and industrial undertakings upon primitive nature have led and are leading to the disappearance of scientifically interesting and even unique natural objects and types of scenery. A widespread feeling has arisen that as much as possible should be done to prevent such destruction, and this has recently led, not only to much local effort directed to this end, but in Prussia to the institution of a special State department under the Minister of Education for the purpose of directing and co-ordinating such efforts. This department has no funds for the purchase of land bearing natural monuments, but it is prepared to direct, assist, and initiate all movements of the kind. Its efforts have already (during the single year of its existence) met with considerable success. In the opinion of Professor Conwentz, procedure by Government department is not the right method in this country; we should rather depend upon voluntary effort. He called attention to various organisations which were doing work of such a character, and suggested that their efforts might be co-ordinated under the auspices of the British Association (see also p. 607).

Among papers in other sections dealing with geographical topics, mention should be made of Sir David Gill's presidential address, which included an account of the progress of the great African Arc of Meridian, which, as has been mentioned elsewhere (p. 601), is now within fifty miles of the southern end of Lake Tanganyika. In Section A (Mathematical and Physical Science), the address of the President, Professor A. E. H. Love, dealt with the subject of a dynamical theory of the figure of the earth, and of the origin of continents and oceans.

At the meeting of the general committee on August 2, Mr. Francis Darwin was elected president for next meeting, which is to take place at

Dublin from September 2 to September 9, 1908. The meeting in 1909 is to be held at Winnipeg, Canada, where an influential local committee has already been formed to forward the arrangements for what is expected to be a very successful meeting.

GEOGRAPHICAL NOTES.

ASIA.

The Anglo-Russian Convention.—The accompanying sketch-map shows the spheres defined by the recent Anglo-Russian Convention. As

MAP OF PERSIA SHOWING SPHERES OF EXPLOITATION
as defined in Anglo-Russian Convention, August 1907.



will be noticed, the spheres belonging to the two Powers are separated by a neutral zone, in which each Power engages not to oppose concessions sought by the subjects of the other.

Dr. Stein's Expedition.—Further communications have been received from Dr. M. A. Stein concerning the progress of his official expedition in Central Asia. They are dated from An-shi, in the north-west of the Chinese province of Kansu, June 18. Dr. Stein started in the last week of February towards the oasis of Sha-chou, better known by its old name of Tun-huang, on the westernmost border of the Chinese province of Kansu. The route taken through the intervening desert was the same which Marco Polo followed, and his description of the route

was found thoroughly accurate in all its topographical details. The ground traversed proved of considerable and varied geographical interest, more than one-third of the route skirting the shores of a vast salt-covered lake, indicating the extent of the Lop-nor marshes at a period perhaps not very remote. Beyond, the detailed survey carried along the route by surveyor Rai Ram Singh showed clearly that the well-marked depressions between the slopes of the Kuruk-tagh and the Altyn-tagh, in which the expedition moved, had once served for the passage of the waters of the Su-le-ho and Tun-huang rivers down to Lop-nor.

Subsequently, Dr. Stein was able to survey, along a line of about 140 miles through the desert to the west of Tun-huang, an ancient system of frontier defence corresponding to the extant "Great Wall" on the Kansu border, the ruins of which were in a remarkable state of preservation. In the Tun-huang region desiccation within historical times has left as marked traces as in the Tarim Basin.

The expedition suffered much from the extremes of the desert climate.

Dr. Sven Hedin's Expedition.—In our May issue (p. 261) an account was given of Dr. Sven Hedin's journey to Shigatse, reached in February last. A new report, dated July 25, gives some account of the explorer's further movements, and reached this country early in October. This report deals with Dr. Hedin's journey from Shigatse to Tok-chen on the Manasarowar Lake. The results, Dr. Hedin says, have been richer than in the first portion of the tour, for he has been almost the whole time in inhabited country. These results include 203 sheets of maps, 410 specimens of rock in connection with geological profiles, 700 panoramas, a meteorological journal entered three times daily, detailed measurements of the volume of water at every river crossed, a collection of plants, and a great number of sketches. The contributions made to the physical geography and hydrography of Tibet include the measurement of one large lake, Amtchok-Tso, the measurement of the heights of many peaks and passes, and the correction of existing maps in a number of important particulars. The route of Major Ryder and Captain Rawling between Shigatse and Manasarowar was avoided as much as possible, and of the eighty-four days spent on the march only two and a half were on the Tasam, the high road they followed. At seven points Dr. Hedin crossed their route, and wherever he came in contact with their map he was filled with admiration for the excellent work they had done. He regards their triangulation as the very best ever carried out in Tibet. Following the northern bank of the Tsan-po (Brahmaputra), and then the Ragha-Tsanpo, Dr. Hedin crossed the gigantic mountain range which is a watershed between the Brahmaputra and the self-contained lakes in the heart of Tibet. Crossing by the Chang-lung-polla, Dr. Hedin camped at the eastern foot of Targu-ganpi, one of the most magnificent snow mountains of Tibet, and like Kailas (or Gangrimotche) regarded as holy by the people. He was in sight of Dangrayum-tso when fifty mounted men stopped him, and told him he could go wherever he liked, only not to the holy lake. Consequently he

travelled to the south-west, to the source of the Ragha-Tsanpo. He found that the map of the region was nothing like the reality. Nain Singh's Mun-tso is situated not south but west of Dangra-yum-tso, but four days south-south-west of the last there is a large lake, Shuru-tso. He was not able to cross and measure this lake, as the ice was just breaking up. To the south-west of the lake was a high snow-range, a ramification from the head range. This last he crossed and reached Amtchok-tso, which he sounded all over. He also measured Dok-chu, the greatest of all the tributaries above Shigatse, and My-chu, a tributary from the northern high range to the Ragha-Tsanpo, and its north-east tributary Buchu. He was able, in fact, to get a clear idea of the situation and power of all the different rivers in that part of Tibet. Dr. Hedin reports with deep regret the death, from apoplexy, of his caravan *bashi*, Mohammed Tsa. The death occurred at Saka-dzong, whither Dr. Hedin had sent the head caravan in advance, under Mohammed Tsa. From Saka-dzong the explorer went by the northern track much used by brigands to Tradum, and thence, after a long diversion southwards, to Tuksum, and Shamsang. Sending on the main caravan to Tok-chen, he went up the Kub five short marches, to where it comes out in three branches from three different glaciers of very considerable size. Enormous moraines built up by the three glaciers cover the country all round, and the present front and lateral moraines are still gigantic.

AFRICA.

Laké Chad and the Yo River.—Lieutenant Secker, an officer in Northern Nigeria, has been lately engaged in a survey of the river Yo, an important tributary of Lake Chad between Damjiri and Hadeija. He reports that where the river is sufficiently shallow the natives are in the habit of erecting fish dams, which gradually collect large masses of weeds, and lead to the formation of large areas of marsh land, thus diverting water which would otherwise flow into the lake. This fact, in his opinion, may have something to do with the drying-up of the lake. The river, in the regions studied by Lieutenant Secker, is very sluggish, the velocity when it is at its height not exceeding a mile an hour. No rocks obstruct the bed, and with a very slight expenditure he believes that it could be made readily navigable by steam launches from Damjiri to Kano, at least in the period when it is full.

The Surveys of British Africa.—We have received the second annual *Report* of the Colonial Survey Committee, dealing with the Surveys of British Africa. This Committee was constituted in August 1905, as an Advisory Committee, formed at the instance of the Secretary of State for the Colonies to advise him in matters affecting the survey and exploration of British Colonies and Protectorates, more especially those in Tropical Africa. It is the duty of the Committee to make such recommendations as will ensure the rapid and economical prosecution of accurate surveys where these are required, and the rendering of the results available as speedily as possible for use by the Home

Government, the Colonial Governments, and the public. The present Report, which is illustrated by photographs and index maps, gives not only a review of the work done during the past year, but also an account of the present state of the Surveys of British Africa, and of their history.

During the past year a total area of about 49,000 square miles has been topographically surveyed in the field, this total being distributed as follows:—Orange River Colony, 8000 square miles; Cape Colony, 17,000 square miles; East Africa, 2400 square miles; Uganda, 250 square miles; Gold Coast (includes work previously in hand), 16,000 square miles; S. Nigeria (partial), 5000 square miles. The results of the Nigeria longitude expedition have been computed, and have proved of satisfactory accuracy. The British South Africa Company has completed the measurement of the meridian 30° E. of Greenwich as far north as a point within 70 miles of Lake Tanganyika. Geographical exploration has been proceeding in the Anglo-Egyptian Sudan. Cadastral Surveys have also been in progress in the Anglo-Egyptian Sudan, Gold Coast, Uganda, and East Africa. In the last-named Protectorate an area of 870,267 acres was surveyed during the year, while in the Sudan 578,000 acres have been surveyed during the year. Two Boundary Commissions have been at work during the year. These are, first, the Anglo-French Niger-Chad Commission, which is in process of demarcating the frontier to the north of Northern Nigeria; second, the Anglo-Congolese, Ugando-Congo Commission, which is mapping the country in the neighbourhood of the meridian 30° E. of Greenwich, from the parallel 1° S. to the Nile-Congo watershed. This Commission has instructions to prepare a joint map and to come to an agreement as to the geographical features. During the year also general maps have been published of British Central Africa, the Gold Coast and Northern Territories, and the Gambia. Boundary maps have been published of the Anglo-Portuguese (Zambesi) frontier, and the Anglo-German (Niger-Cameroon) frontier south of the Cross River; provisional sheets have been printed of the Anglo-German frontier east of Lake Victoria. Topographical sheets have also been published of Orange River Colony (military edition), the Cape Colony, East Africa, Gold Coast, and Africa, 1 : 1,000,000, and 1 : 250,000 compilations.

The Report also contains a detailed account of the surveys now being carried on in different parts of British Africa, with a historical sketch of the origin of the survey, and a statement as to the maps at present available, which will be found exceedingly useful for reference. It is clear from the Report that much is now being done to ensure the systematic mapping of British Africa.

The Frontier of Liberia.—According to a note in the *Times* an arrangement has been now come to between the two republics of France and Liberia as regards the Franco-Liberian frontier. The *Times* gives the new frontier as follows:—The line starts at a point on the Sierra Leone frontier where the Makona river passes into British territory, and follows that river upstream to about $8^{\circ} 30'$. It then dips somewhat to the south towards the eighth parallel, to a great extent skirting the

edge of the Great Forest. It is then carried on in a slightly south-east direction to the northern source of the Nuon or Western Cavalla, which river it follows south to its junction with the main Cavalla, which forms the eastern boundary of the republic from the junction to the sea. On the map this arrangement gives to France a large area of Liberian territory, but it appears that, according to French surveys, the Nuon and main Cavalla have a more southerly direction than is shown on the existing maps. As a reference to Sir Harry Johnston's *Liberia* (vol. i. p. 311), will show, the new arrangement is practically that suggested by France a couple of years ago, and involves the giving up by Liberia of territory to the north of the Cavalla river, an area of about 2000 miles in the extreme upper basins of the St. Paul and Lofa rivers, as well as a band of territory to the east of the Nuon river which has hitherto ranked, theoretically at least, as Liberian. On the other hand it gives Liberia a tolerably well-defined boundary from the geographical standpoint, in place of the previous purely conventional one.

POLAR.

The Scottish Arctic Expedition.—Dr. W. S. Bruce returned to this country at the end of September from his second expedition to Prince Charles Foreland, Spitsbergen (cf. pp. 319 and 491). Owing to the fact that Dr. Bruce was obliged to change his plans because of the very unfavourable season, the return of the expedition was somewhat delayed, a fact which gave rise to some anxiety, happily speedily relieved by the appearance of the party in good health and after the accomplishment of some excellent work. We hope to publish here later a full account of this work, in continuation of Dr. Bruce's previous paper (cf. p. 141), but meantime the following brief summary of results will prove interesting. As the result of the topographical surveys a detailed chart has been constructed of the whole of the west coast of the Foreland on the scale of 2 inches to a mile, while a similar survey has also been made of the mountainous interior and of a part of the east coast, with the result that the outline of the island is now for the first time accurately known. In the neighbourhood of the south and north Base Camps more detailed surveys have been made. New fossil-bearing beds have been discovered which appear to be older than the Tertiary strata previously discovered by Dr. Bruce. A number of birds have been collected, including some species new not only to Prince Charles Foreland but also to Spitsbergen. The collection of plants made by the expedition also includes forms not previously recorded from the island. Frequent meteorological observations were made during the party's visit to the island. There still remains, however, some work to be done, and Dr. Bruce hopes to return at some later date to finish this.

The Prince of Monaco's Spitsbergen Expedition, 1907.—His Serene Highness the Prince of Monaco returned with his yacht *Princesse Alice* from Spitsbergen at the end of August, having completed the hydrographical work in Cross Bay which he commenced last year. He again chartered a small steamer, the *Kvedfjord*, on board of which he had

a Norwegian party under Captain Isaachen, who carried out a survey chiefly of the region between Cross Bay and Magdalena Bay. The Prince also carried out a number of investigations of the higher atmosphere by means of kites and balloons. The ice and weather conditions were extremely unfavourable and forced the Prince to leave Spitsbergen rather earlier than he had intended. Dr. Jules Richard, Captain Bourée, Dr. Portier, and Professor Hergesell were among those who accompanied the Prince as his scientific staff.

Mr. Harrison's Expedition.—Mr. A. H. Harrison returned to this country in October, at the close of his Arctic expedition (cf. this *Magazine*, p. 549). Mr. Harrison hoped at one time to remain another year with the object of carrying out his original plan of investigating the possible existence of land in the Beaufort Sea, but he has been obliged to abandon this scheme. Although this problem still awaits investigation, Mr. Harrison has done a large amount of useful work, not only in the direction of surveying, but also in regard to the habits, etc., of the Eskimo, with whom he lived for about eighteen months.

Cruise of the "Belgica," July-September 1907.—H.R.H. the Duke of Orleans (cf. p. 209) on board his polar ship *Belgica*, has made an interesting cruise this summer into the Kara Sea, accompanied by Captain de Gerlache, Lieutenants Bergendahl and Rachlew (magneticians), Dr. Récaimer, surgeon and biologist, and Mr. Stappers, biologist.

The *Belgica* left Vardo on the 9th of July, and without meeting any ice in the Barentz Sea entered the Matochkin Shar on the 13th. Breaking belts of continuous ice still remaining in the Straits, she penetrated without difficulty into the Kara Sea on the 14th of July. The ice looked very heavy to the north and east, but to the south-east it was fairly open. During one day the ship worked her way in calm and fine weather. On the 15th, however, a light wind came from the NE. which developed on the 16th into half a gale. In a few hours the ice closed around the ship which was beset near the coast about $72^{\circ} 40'$. For five weeks the wind continued northerly, mostly NE., and the pressure of the ice not relaxing, the *Belgica* remained beset for the whole of this period. The ship drifted slowly first (two miles a day), then faster to the SE. Throughout this trying period quite a number of most interesting scientific observations were made and not of least interest were the daily notes of the drift, which was to the SE. and SW. On the 21st of August the *Belgica* was released, and came out of the Kara Straits into the Barentz Sea again in a mass of drifting floes. In the Straits for the last day the drift was $2\frac{1}{2}$ miles an hour.

During this drifting continuous meteorological observations were made and many soundings and samples of water were secured, and the biologist had his dredge or "tangle" out daily and collected many specimens of the marine fauna, including especially asteroids and amphipods. After her release, the *Belgica* tried to re-enter the Kara Sea by the north, sailing along the west coast of Nova Zemlya, but owing to a severe

grounding on a rock, which seriously damaged the ship and obliged the party to throw overboard the greater part of their coal, the Duke of Orleans was forced to limit his voyage. In spite of this further misfortune, however, the *Belgica* rounded the great ice cape of the north of Nova Zemlya, and before turning homeward made a line of complete oceanographical stations on the 78th degree between Nova Zemlya and Franz-Josef Land. After a rather stormy passage the ship reached Hammerfest on the 14th September.

GENERAL.

Centenary of London Geological Society.—This society celebrated its centenary at the end of last September, the Royal Scottish Geographical Society being represented at the celebrations by its President, Professor James Geikie. On Thursday, September 20, the main proceedings began with the presentation of addresses by delegates from foreign countries, and also by representatives of the Universities, learned societies, etc., of Great Britain. In the afternoon Sir Archibald Geikie, President of the Geological Society of London, delivered an address on "The State of Geology at the Time of the Foundation of the Geological Society," while in the evening a banquet was held at the Hotel Metropole. On the following day visits were paid to various museums, especially to the Museum of Practical Geology at Jermyn Street, where a demonstration on the recently added model of Assynt in the North-West Highlands was given by Dr. Peach. In the evening a dinner and conversazione were held. During the week prior to the celebrations a number of excursions to places of geological interest in Great Britain were arranged, especially for the benefit of the foreign delegates.

COMMERCIAL GEOGRAPHY.

The Nyasaland Railway.—In connection with the recent alteration of name of the British Central Africa Protectorate (cf. p. 546) it is of some interest to note the progress of the Shire Highlands railway, which is to be the outlet of this colony, so interesting to Scotland because of its association with David Livingstone. The only natural outlet for the region is the Shire river, which flows out of Lake Nyasa at about 1500 feet above sea-level. Both the Shire and the Zambesi are, however, much obstructed, and the colony is practically isolated for about half the year. The primary object of the railway was to get over the obstruction caused by the Murchison Falls, and to afford regular communication between Chiromo and the capital Blantyre, with ultimate extension to Fort Johnston on the lake. When work was started, however, it proved impossible to transport the heavy railway material by water to Chiromo, and the company were therefore obliged to extend the line downwards to Port Herald, thirty miles below Chiromo, and sixty miles above Villa Bocage, which is in Portuguese territory and is the real head of the perennially navigable section of the river. The further extension of the line down to this last point will have to be contemplated in the future. Port Herald is 210 miles from the sea-

port of Chinde, at the mouth of the Zambesi river. From the former port the line runs in a northerly direction to Chiromo, where it crosses the Shire river. Above this point it leaves the Shire valley for that of the Ruo river. After the sixty-fourth mile this valley is again quitted for that of the Tuchela, which is followed for ten miles. The line then follows the Luchenza river almost to its source, reaching its summit point of about 4000 feet above sea-level, whence the descent is made upon Blantyre, 112 miles by rail from Port Herald. It is expected that Blantyre will be reached before the end of the present year.

Commercial Possibilities of West Africa.—In a paper read at the Royal Colonial Institute in March of the present year, and printed in the *Journal* of Proceedings of the Institute, Viscount Mountmorres in a very interesting way draws attention to some of the possibilities of British West Africa. He points out that with the exception of the Senegal all the important rivers in the northern section of West Africa are British at their mouths, and that Sierra Leone is capable of being made one of the finest harbours in the world. Much of the British territory then in this region is easy of access by shipping, a great advantage in the development of a new country.

The physical features of the country may be summed up as follows:—the Coast range follows the curve of the Gulf of Guinea, and though sometimes rising direct from the sea, has generally between it and the ocean a flat, monotonous plain, fringed by the white sand of the foreshore. This plain is almost everywhere barren, arid, and parched. Its rainfall is small, and the soil is either laterite rock or bleak sand. Throughout the length of the plain are the lagoons, sometimes mere pools on the shore, but at other times vast expanses of water, as for example the Great Lagoon, which stretches almost the whole length of the Ivory Coast. Round the landward margin of these lagoons there is usually luxuriant vegetation, but elsewhere the coast-plain only produces rank tough grass. Within the coast range is the really valuable region of West Africa. It consists of undulating country, well watered and densely clothed with forest, with an abundant rainfall, which falls at well-defined seasons. The subsoil is formed of stiff clay, through which laterite in some places and conglomerate in others crops out. Whereas in other parts of West Africa the covering of soil is very thin, here it varies in depth from three or four inches to as much as three feet, and fifteen inches to two feet is a very common thickness. The width of this forest belt varies greatly, from about two hundred miles in the east of Sierra Leone, the west of Liberia, the east end of the Ivory Coast and the west end of the Gold Coast, to thirty or forty miles at the east of the Gold Coast, while at Freetown it thins out to a point. Within the forest belt is the savannah country, a down-like formation of grassland interspersed with clumps of scrub and freely sprinkled with stunted trees and a certain amount of cotton woods and baobabs. The subsoil is laterite, and the surface soil is very scanty. There are no large rivers, and streams are few; the rainfall

also is small and the seasons irregular. In other words, this region resembles the coastal plain. Where there is sufficient water it is a pastoral country rich in flocks and herds. The richest band is therefore the forest belt which contains an enormous variety of valuable products. Of its natives the author speaks very highly. As has also been done in Madagascar, he further emphasises their profound, if empirical, knowledge of agriculture, and the rapidity with which they learn new methods from the white man, and compete successfully against him. The current statements as to their haphazard method are due to imperfect observation in most cases, and the methods adopted are those which long experience has shown to be the only profitable ones. Viscount Mountmorres gives it as his opinion that the development of the natural resources must remain in the hands of the natives, and that the white man should devote his energies first to teaching the natives new methods and introducing new cultivated plants; and second, to so improving the means of communication as to set free the enormous amount of native labour now absorbed by portage. When this is done the trade will increase enormously, and there will be large possibilities of profit for the white man in acting as trader in the native products. In conclusion, the author pays a high compliment to the efficiency and economy of the administration of British West Africa.

PERSONAL.

Mr. Robert C. Mossman, F.R.S.E., of the Scottish Oceanographical Laboratory, left Edinburgh on October 10th for Buenos Aires, to take up his appointment there as director of the scientific reports of the Argentine Meteorological Office.

We are informed that the Geographical Scholarship in the University of Oxford has been awarded for 1907-8 to R. L. THOMPSON, B.A., Keble College.

EDUCATIONAL.

Teachers desirous of giving lessons on the evolution of means of communication will find some interesting illustrative figures in Viscount Mountmorres's paper on West Africa, summarised on p. 605. In West Africa at present all up-country produce has to be carried to the coast on men's heads. The maximum load so carried by each man is seventy to eighty lbs., and sixty lbs. is a fair average. The native carrier at best does not do much more than twenty to twenty-five miles per day with this load, so that it takes forty men a day to carry a ton of produce twenty-five miles. That is, it would take forty men eight days to carry a ton of produce from London to Liverpool. In other words, it takes a far greater amount of labour to carry the produce to the coast than to raise and prepare it, so that the bulk of the community is engaged in transport rather than in productive labour. The improvement of the means of communication would thus set free an enormous amount of

additional labour which could be used in the development of the country. Even a De Cauville tramway worked by human traction would effect an enormous improvement, for a native on such a tramway can push a truck containing six hundred lbs. for nearly double the distance that he can walk carrying a load; that is, by this simple contrivance he can do the work of eighteen men, and so enormously diminish the cost of transport. Another very interesting point in the same paper shows the danger of applying economic principles without consideration of the local conditions. It has been found that in West Africa the raising of the price of a commodity does not increase the supply of the commodity, but diminishes it. The reason is that the native's wants are very few, and if, for example, the price of rubber rises, he finds that whereas the bringing of a pound of rubber would formerly keep him for a month, now twelve ounces would be sufficient to keep him for the same length of time, and therefore he brings only the smaller quantity.

At the Leicester Meeting of the British Association, as noted above on p. 597, Professor Conwentz gave an address on a subject in which he is greatly interesting himself—a subject which can only be somewhat clumsily translated into English as the preservation of natural monuments. Natural monuments are all natural objects of interest, especially those which throw light upon the past history of the region in which they occur. For example, in our own country, while the lower ground has certainly been everywhere profoundly altered by man, there is reason to believe that in many parts of the Highlands the vegetation which now covers the surface has so covered it for countless ages, and is in short a vestige of the primitive covering. Such an area is a natural monument in Professor Conwentz's sense. Similarly morainic heaps, erratics, ice-scratches, the alpine plants of the Scotch hills, the flora of our sand-dunes, and so forth, all rank as natural monuments, as objects of scientific interest which enable the geographer to reconstruct past conditions. If, as most persons admit, it is of great importance to preserve from the vandal the historic monuments of a country, the Druidic circles, the Roman remains and so forth, it is surely also of importance that the value of the natural monuments should be understood and appreciated, and so far as possible preserved from wanton destruction. To protect the rare alpine plants from the over-zealous gardener, the rare and disappearing animals from the over-zealous collector or the ignorant gamekeeper, these are objects worthy of all encouragement. Professor Conwentz has published various pamphlets in German, one of which has been sent to us, not only discussing the means to be adopted to ensure, so far as may be, the preservation of such natural monuments, but also describing the more important of these in parts of Prussia with the object of preserving them against accidental destruction, and explaining their existence to the public in general. We understand that there is a prospect that a book or pamphlet may be published on similar lines here, with Professor Conwentz's collaboration. The subject is one of great interest to teachers and all persons engaged in Education.

NEW BOOKS.

EUROPE.

Baedeker's Eastern Alps. Eleventh edition. Revised and augmented, 1907.

Price 10 marks.

Baedeker's Paris and Its Environs. Sixteenth revised edition, 1907. Price

6 marks.

Baedeker's Switzerland. Twenty-second edition, 1907. Price 8 marks.

Baedeker's Southern France and Corsica. Fifth edition. Price 9 marks. Leipsic :

Karl Baedeker. London : Dulau and Co. New York : Scribner's Sons.

The philosophic traveller may derive some profit from the comparison of the varying numbers of the editions of the little red books which accompany him on his journeys. For example, as will be noted above, while *Switzerland* is in its twenty-second edition, and *Paris* in its sixteenth, *Southern France* is only in its fifth. If the competition of other guides has some effect on the rate of sale of the different volumes, yet in general it may be said that the number of the edition enables us to gauge with approximate accuracy the extent to which any particular country is frequented by English-speaking tourists. It is obvious, for instance, from a mere comparison of the editions of the guides, that the Dauphiny is not frequented by such travellers to the same extent as Switzerland, and personal experience but confirms the deduction. In the guide itself, indeed, attention is drawn to the fact that the French Alps are even yet much less visited than they deserve to be. We think, however, that the new edition of *Southern France* tends to discourage an increase of visitors by a more gloomy account of the hotels than is justified by the facts. If English tastes and English ways are less considered than in Switzerland, the adaptable tourist can yet be almost always certain of finding cleanliness and tolerable food everywhere.

Another point which strikes the reviewer who is confronted with a collection of "Baedekers" is the extraordinarily artificial nature, from the travellers' standpoint, of political frontiers. For example, the tourist who crosses the Col de Mt. Cenis on foot finds to his disgust that his guide fails him soon after he has passed that wind-swept, mist-drenched plateau, and he is curtly referred to *Northern Italy* for further information. In actual travel, of course, this means that the loaded knapsack has to contain two guides—a serious consideration. But even in this respect the guides are not consistent. As every one knows, accounts of Chamonix and Upper Savoy are included in both *Switzerland* and *Southern France*, while the very title of the *Eastern Alps* indicates an indifference to political frontiers. Would it not be possible to carry out this policy on a bolder scale, and discuss the Alps in a series of volumes, based upon the order in which travellers usually visit them rather than upon political boundaries, much as is done in Ball's *Guides*?

AFRICA.

La Pénétration Saharienne (1830-1906). Par AUGUSTIN BERNARD et N. LACROIX. Alger, 1906. Pp. 195.

For many years the illusion was cherished in France that the Sahara and the country to the south of it was rich, that it abounded in gold and possessed great possibilities in the way of trade. This vision of wealth is now dispelled. The Sahara is now known to be not a vast plain but a huge region with mountains,

plateaux, and depressions, yet only habitable where there is enough water to form an oasis. For the curse of the country, its extreme aridity, is not due to the quality of the soil, but to the meteorological conditions of the climate. The Tuaregs live a nomad life in a state of semi-starvation and perpetual war, and the whole population of the northern Sahara, with an area larger than France, only amounts to 300,000. The economic value of the Sahara is extremely small, the only articles of exchange being salt and dates. The value of the whole commerce from the Sudan to the sea by way of the Sahara is only valued at about nine millions of francs (£360,000), and is constantly diminishing. Yet to gain this insignificant trade France has had to spend millions of francs and to deplore the loss of many valuable lives.

In a very compact and yet highly readable form the two very competent authors narrate the history of the French occupation of Algeria from 1830, when Algiers was captured, down to the present time. Up to 1852 direct exploration of the Sahara had yielded hardly any result, and the occupation of Algeria only extended as far as Laghuat, or not quite 3 degrees south of Algiers. By 1864 French influence extended over nearly all the territory north of the Areg, especially at important points like Tuggurt and Wargla, the latter of which lies about 2 degrees south of Laghuat. It did not pass these limits till the end of the nineteenth century. The period from 1864 to 1879 was one of stagnation, which may partly be attributed to local insurrection and the war of 1870. The year 1881 was marked by two important events—the establishment of a protectorate over Tunisia and the destruction of the Flatters expedition about lat. 24° N., when all the eleven European members of the expedition lost their lives, and only a few natives escaped. This massacre naturally gave a severe blow to French prestige in the Sahara, from which it took long to recover. The unfortunate part of the business was that it need not have occurred. The mistake lay in trusting the natives too much and not providing Colonel Flatters with an escort of French soldiers. With a couple of hundred soldiers there would have been no danger, and the expedition would have effected its purpose. The next nine years form a period of inaction, and it was not till 1890 that the penetration of the Sahara received a new impulse. Now the French began to push up the Senegal and the Niger in the direction of Timbuctu and Lake Chad so as to turn the flank of the Sahara. In this year a convention was signed, in which the British Government acknowledged the zone of French influence to extend as far south as the line from Say on the Niger to Barruwa on Lake Chad. Five years later Timbuctu was taken, and in 1899 another convention was signed with Great Britain which fixed almost definitely the limits of the French Colonial Empire in Central Africa. Since that date the French have kept on occupying effectively more and more of the oases of the Sahara, thus reducing the power for mischief of the Tuaregs. Various lines of railway have been studied, and in 1895 it was possible to travel from Oran to Colomb by rail, a distance of 744 kilometers. In what direction the line will be prolonged is not yet decided, and a decision indeed is difficult, for the Sahara is so poor that no railway across it could ever be made to pay the expense of its construction.

The Gambia Colony and Protectorate. An Official Handbook. By FRANCIS BISSET ARCHER, Treasurer of the Colony. London: St. Bride's Press, Ltd. Maps and illustrations. Price 10s. net.

The Gambia has been an independent Crown colony since 1888. In this handbook the Treasurer of the Colony has prepared a full, lucid, and concise account,

historical, physical, political, economic, and personal. The work is divided into nine parts. The first deals with the history and development of the Gambia, in which the history of exploration and commercial adventure as well as the political and administrative records are narrated with accuracy and judgment. The Gambia affords a good illustration of the many vicissitudes through which the territories in British West Africa have passed; and the success there achieved is alike in its record and in its promise a worthy monument of British enterprise, energy, skill, and probity. Mr. Archer has divided his review of the past into four periods: from the earliest records to the founding of Bathurst; from 1820 to 1852; from 1852 to 1865; from 1865 to 1904.

The second, third, fourth, fifth, and sixth parts are occupied with the geography, topography, and administrative system. In the third part there is an account of the colony during the last decade which gives important details regarding the economic aspects. "The colony is united," says the author in conclusion, "prosperous, and free from endemic disease, and Bathurst, the seat of Government, can now be compared favourably with any other town in the West Coast of Africa. Both colony and protectorate would seem to have emerged from the darkness of a troubled past into the dawn of a future which, it may reasonably be hoped, shall never be seriously overclouded." Medical and sanitary science, it is recognised, have contributed greatly to the possibilities of progress by reducing the climatic disabilities of human efficiency.

The seventh part consists of an English-Mandingo dictionary of some eight hundred words and phrases in common use. This language is that principally used throughout the colony and protectorate. The remaining parts are concerned with the personnel of the Government departments; information about the several services; financial and commercial details; fiscal arrangements; a local directory; and general information on the manifold aspects of life in the colony; and finally a list of officers and record of their services. The work is, therefore, not only a record and account, but a useful reference book to the colony. A bibliography might well be added in a new edition.

AMERICA.

Canada's Century. By R. J. BASSETT, F.R.G.S. London: The Financier and Bullionist, Limited, 1907. Price 6s. net.

This account of a prolonged business tour in Canada is an expansion and exposition of the saying of Sir Wilfrid Laurier, "The Nineteenth Century was the century of the United States; the Twentieth Century will be Canada's Century." Canada is at present much in our minds, and there is no lack of literature concerning it: this book, however, pursues a plan of its own. It is not historical nor descriptive nor political, and in one sense, perhaps, hardly geographical. It is a statement of a business man to business men, a statement of the resources of Canada actual and potential. It deals with the cities of the Dominion, Quebec and Montreal, Ottawa and Toronto, Halifax and St. John, Winnipeg and Vancouver, Edmonton and Calgary: with the means of communication, the Canadian Pacific Railway, the Grand Trunk Railway, and the Canadian Northern line, which is linking the manufactories of Ontario with the agricultural regions of the North-West. The description of the docks and huge elevators of Port Arthur leads to a long and careful analysis of the conditions of agriculture, grain-growing, dairy-farming, mixed farming, cattle and horse ranching and fruit-growing. On this agricultural survey follow a statement of the mineral resources—iron and coal, gold and silver, copper and nickel—and a full exposition of

Canadian forestry and fisheries. Turning to the nascent manufactures of Canada the writer details the efforts that are being made to use the unrivalled water power of the country for the service of man. This is the most impressive part of the volume, we are brought face to face with the great forces of nature. In the words of Bacon "nil aliud potest homo quam ut corpora naturalia admoveat et amoveat: reliqua Natura intus transigit."

The book breathes a spirit resembling the optimistic confidence of the Canadians themselves. Canada (so we are repeatedly told by the writer) only needs for its development strong and steady settlers and a wise and well-administered outlay of capital, and these can be best supplied by the mother country. The field is open now, but in a few years, if we hesitate and delay, it will be occupied by foreigners. Let us act before it is too late!

The volume deserves careful perusal and consideration.

GENERAL.

Comparative Art. By EDWIN SWIFT BALCH. Philadelphia: Press of Allen, Lane and Scott, 1906.

The title of this volume is more comprehensive than its contents, for in the main the author is concerned with glyptic art alone, purely decorative ornament being neglected. It would manifestly be impossible in 154 pages and without the aid of a single illustration to go deeply into the matter of comparative art, and the author has not attempted it. Without being slavishly methodical in the selection of his material for discussion, he presents us with a readable and entertaining *causerie* on the subject of his choice. He is animated by a desire to throw a new light on the history of man by studying the art of as many races as possible and so estimate the æsthetic and mental similarities and divergencies between them. Accordingly he takes a glance at the manifestations of glyptic art ranging from the later palæolithic to modern times, embracing the whole world in his survey.

One of his principal conclusions, that art has originated spontaneously in different centres, is not likely to be disputed. But another conclusion, "that man did not spring from one stock in one locality, but that he evolved several hundred thousand years ago in several different places in the world," will only be accepted by those who already on other grounds maintain that hypothesis. For it is evident that there is no logical connection between these two opinions. As the author himself has shown, no art of the earlier palæolithic period has come to light and some existing peoples seem to be devoid of any artistic impulses whatever. So far as our evidence goes we are therefore justified in assuming that in the earlier stages of the human race, when it was gradually spreading over the earth's surface, it had not sufficiently developed in civilisation to produce any objects which can be classed as artistic. Man may have been potentially artistic from the beginning just as a normal infant is born with the potential faculty of walking and of speech, though this latent power takes time to become perfect. With this in mind we are quite able to accept the proposition that art developed spontaneously in different parts of the world, just as language may have done, without conceding that the human race sprang from different stocks. It may have done so, but this cannot be proved by anything we can learn from the comparative study of art since no known artistic relics reach back far enough in time.

It may be questioned whether some of the author's generalisations are not so large that they become practically useless for the ethnologist. Any art in which

the proportions of the human form are well preserved is classed as "White Race Art," and under this heading he includes both Egyptian and Hindu art. And by doing so he seems to think that he has disposed of the possibility of the ancient Egyptians being of Semitic or Hamitic stock. In justice to the author it must be said that he considers his conclusions as mere personal opinions which will doubtless be changed by the acquisition of new facts.

L'Or dans le Monde. Par L. DE LAUNAY. Paris: Armand Colin, 1907.

Price 3fr. 50c.

Professor De Launay of l'École Supérieure des Mines has written several books on Geology in general, but in this one he confines himself to the important subject of Gold. He considers it first from a geological, and then from a geographical, point of view, discussing next the mining and metallurgical extraction, and the economics, of gold. In connection with the last he points out that "during the past ten years two great political events have exercised an influence more or less direct on the question of gold in such a manner as to interrupt the normal evolution of the industry, increase its value, and favour its investment. The first event was the conquest of the Transvaal by the British. This conquest, which the capitalists of South Africa had, with more or less sincerity, favoured or encouraged in the pretended interest of their industry, has, as was inevitable and as was easy to be foreseen, paralysed for a long period its development. In the first place we witnessed the complete stoppage of the mines during the two years of the war (which began by being considered only a military promenade) and the destruction of machinery and works, fortunately on a limited scale. But above all the nett cost, which ought to have fallen at least one-third by a change of government, has, including taxes, remained the same at the end of ten years in spite of all the technical progress made in the interval. Instead of the feeble taxes of the Boer Government, against which such a noisy campaign was directed, the heavy and costly British administration has to be paid for; charges have been greatly increased; the negroes have lost the habit of working in mines, and the absurdly impracticable idea entertained for a moment of reducing their wages by a sudden stroke of authority has caused a scarcity of labour which could only be remedied by the introduction of Chinese, which led, at least in the beginning, to much trouble. At the same time, the liquidation of the enormous cost of the war has occasioned in the British market a diminution of capital and a depreciation of prices which affected every market in Europe. Then the great industry of Gold became entangled in British politics. The question of Chinese labour having been brought into the political arena and the Liberal party having pronounced against it, credit has been refused, capital has been withdrawn, progress has been arrested, and at the same time cost has been increased. Finally, the result has been that the amount of gold which the Transvaal ought to produce to-day has been very materially reduced. By a veritable political paradox, what ought to have increased these troubles will probably diminish them, for the Boers, beaten in battle in 1900, have recovered power in their country owing to their electoral victory in the beginning of 1907, and the directors of the mines have (in February 1907) hailed with satisfaction the accession of the ministry of General Botha, the old military antagonist of Britain, only too glad to welcome him as a relief from the follies of the so-called Liberals by means of which the British Government threatened to ruin them." While it is always useful to "see ourselves as others see us," it is a pity that Professor De Launay did not visit the Transvaal and form his opinion from personal experience there.

A Scientific Geography. Book IV., North America. Book V., Africa. By ELLIS W. HEATON, F.G.S. London: Ralph Holland and Co., 1907. Price 1s. 6d. net. each vol.

These manuals are called "Scientific" because in them stress is laid on agricultural and industrial developments which are traced to their physical causes. They are meant to prepare students for examination and are drawn up with skill and care. While they can hardly bear out their claim to be "interesting," they are at least suggestive and the information given is accurate and clearly conveyed. The plan of presenting the facts twice over, first in a general and then in a local setting, is calculated to impress them on the memory. The maps are worthy of special commendation, and an intelligent scholar will learn much from a careful study of them. The books themselves are valuable rather as a help towards testing and summing up previous study than as a means of teaching geography.

NEW MAPS.

EUROPE.

ORDNANCE SURVEY OF SCOTLAND.—The following publications were issued from 1st to 30th June 1907:—One-inch Map. Third edition, engraved, in outline. Sheet 44. Price 1s. 6d. Third edition, printed in colours and folded in cover, or flat in sheets. *Rothsay*, Sheet 29; *Balquhiddy*, Sheet 46. Price—on paper 1s. 6d.; mounted on linen 2s.; mounted in sections 2s. 6d. each. Special maps of districts. *Glasgow*.—(Third Edition). Price now altered to 1s. 6d. on paper flat or folded; 2s. mounted on linen flat or folded.

Six-inch and Larger Scale Maps.—1:2500 Scale Maps (Revised), with Houses stippled, and with areas. Price 3s. each. *Edinburghshire*.—Sheets XIII. 7; XIV. 11; XX. 1; XXI. 15.

Note.—There is no coloured edition of these sheets, and the unrevised impressions are withdrawn from sale.

The following publications were issued from 1st to 31st July 1907:—One-inch Map (third edition), engraved, with hills in brown or black. Sheets 35, 38, 44, 47. Price 1s. 6d. each. Third edition; printed in colours and folded in cover, or flat in sheets. *Kilmartin*, Sheet 36; *Kinross*, Sheet 40; *Oban*, Sheet 45. Price—on paper 1s. 6d.; mounted on linen 2s.; mounted in sections 2s. 6d. each.

Six-inch and Larger Scale Maps.—Six-inch Maps (Revised), full sheets, heliographic, without contours. *Sutherland*.—Sheets 104, 105. Price 2s. 6d. each.

1:2500 Scale Maps (Revised), with Houses stippled, and with Areas. Price 3s. each. *Edinburghshire*.—Sheets VII. 8; XIV. 8, 12, 16; XV. 14, 15; XX. 4; XXI. 2, 3, 5, 6, 9, 10, 11, 13, 14, 16; XXIII. 2, 3, 4, 6, 7, 8, 10, 11, 12, 15, 16; XXIV. 5, 9; XXV. 2, 3. Sheets XV. 16; XXI. 7, 12; XXI-A (13 and 9); XXIV. 1; XXVI. 1. Price 1s. 6d. each.

Note.—There is no coloured edition of these sheets, and the unrevised impressions are withdrawn from sale.

The following publications were issued from 1st to 31st August 1907:—One-inch Map (third edition), printed in colours and folded in cover, or flat in sheets. *Jura*, Sheet 28; *Iona*, Sheet 43 and part of 35; Price—on paper 1s. 6d.; mounted on linen 2s.; mounted in sections 2s. 6d. each.

Six-inch and Larger Scale Maps.—Six-inch Maps (Revised), full sheets, heliozincographed, with contours. *Caithness*.—Sheets 6, 10, 11, 12, 18. Price 2s. 6d. each. Sheets 1 (2A and 2), (3A and 3), 4. Price 2s. each. *Sutherland*.—Sheets 104, 105. Price 2s. 6d. each.

1 : 2500 Scale Maps (Revised), with Houses stippled, and with areas. Price 3s. each. *Edinburghshire*.—Sheets VII. 6, 7, 10, 11, 12, 14, 15 ; IX. 5, 6, 9, 10, 13, 14, 15 ; XIII. 2, 3 ; XIV. 2, 4 ; XXI. 1 ; XXIV. 13 ; XXV. 4. *Haddingtonshire*.—Sheets IX. 3 ; XIV. 5, 6, 7, 8, 10, 11, 12, 14, 15, 16 ; XV. 4, 5, 7, 9, 10, 11, 13, 14, 15 ; XIX. 1, 2, 5.

Note.—There is no coloured edition of these sheets, and the unrevised impressions are withdrawn from sale.

The following publications were issued from 1st to 30th September 1907 :—One-inch Map (third edition), engraved, in outline. Sheet 37. Price 1s. 6d. Third edition ; printed in colours and folded in cover, or flat in sheets. *Bowmore and Port Askaig*, Sheet 19 and parts of Sheets 20, 27, 28 ; *Loch Lomond*, Sheet 38. Price—on paper 1s. 6d. ; mounted on linen 2s. ; mounted in sections 2s. 6d. each.

Diagrams—county. Scale four miles to one inch, showing civil parishes, with a table of their areas. *Aberdeenshire and Banffshire*. Price 6d.

Six-inch and Larger Scale Maps.—Six-inch Maps (Revised), full Sheets, heliozincographed, with contours. *Caithness*.—Sheet 17. Price 2s. 6d. Full Sheets, engraved, without contours. *Ross-shire*.—Sheet 98. Price 2s. 6d.

1 : 2500 Scale Maps (Revised), with Houses stippled, and with areas. Price 3s. each. *Edinburghshire*.—Sheets VII. 16 ; XIII. 4 ; XIV. 1 ; XV. 3, 4, 5, 6, 7, 9, 11, 13. *Haddingtonshire*.—Sheets I. (16 and 12) ; II. 5 (6 and 2), 7, (8 and 4), 9, 10, 12, 13, 14, 15, 16 ; IV. 11, 12, 14, 15, 16 ; V. 1, 2, 5, 6 ; IX. 2, 4, 6, 7, 8, 10, 11, 12, 14, 15, 16 ; XIV. 3, 4 ; XV. 1, 3, 6, 12, 16 ; XVIII. 3, 4.

Note.—There is no coloured edition of these sheets, and the unrevised impressions are withdrawn from sale.

GEOLOGICAL SURVEY OF SCOTLAND.—The following publications were issued from 1st to 30th June 1907 :—One-inch Map.—Sheet 55. Drift Edition. Price 6s.

The following publications were issued from 1st to 31st July 1907 :—Six-inch Maps. Quarter sheets, uncoloured. Price 1s. 6d. each. *Edinburghshire*.—7 NE., 7 SE., 13 NW., 13 NE., 13 SW.

Sheet Memoirs.—The Geology of Islay, including Oronsay and portions of Colonsay and Jura. (Explanation of Sheets 19 and 27, with the Western part of Sheet 20) ; by S. B. Wilkinson, with Notes by J. J. H. Teall, D.Sc., F.R.S., and B. N. Peach, LL.D., F.R.S. : Price 2s. 6d.

The following publications were issued from 1st to 31st August 1907 :—Summary of Progress of the Geological Survey of Great Britain and the Museum of Practical Geology for 1906. Price 1s.

TURKEY. General Staff Map on Scale of 1 : 250,000 or about 4 miles to an inch. Sheets—Rodosto, Vize. 1907. Price 2s. 6d. each.

Topographical Section, General Staff, London. E. Stanford, Agent.

AFRICA.

AFRICA. General Staff Map on Scale of 1 : 1,000,000 or about 16 miles to an inch. Sheets—45, Dongola and Berber ; 46, Suakim ; 55, Khartoum ; 66, White Nile and Sobat. 1907. Price 2s. each sheet.

Topographical Section, General Staff, London.

BRITISH CENTRAL AFRICA. General Staff Map on Scale of 1 : 1,000,000 or about 16 miles to an inch. 1906. *Price 4s. 6d.*

Topographical Section, General Staff, London.

CAPE COLONY. General Staff Map on Scale of 1 : 250,000 or about 4 miles to an inch. Reconnaissance Series. Sheets—127 E, Orange River Mouth ; 127 F, Stinkfontein ; 127 K and L, Port Nolloth and O'Okiep ; 128 R, Britstown. 1907. *Price 2s. each sheet.*

Topographical Section, General Staff, London.

This new map is a most valuable contribution to the topography of South Africa, and represents the most complete survey of these districts which has yet appeared.

GOLD COAST. Map published by the authority of Sir John P. Rodger, K.C.M.G., Governor, under the direction of Major F. G. Guggisberg, R.E., F.R.G.S., Director of Surveys, Gold Coast. Scale 1 : 125,000 or about 2 miles to an inch. Sheets—72 W 1, Sekondi ; 72 K 1, Coomassie ; 72 K 111, Oboase ; 72 R 11 ; Accra. 1907. *Price 2s. each sheet.*

W. and A. K. Johnston, Limited, Edinburgh and London.

These sheets are a first instalment of a new map of the Gold Coast, which, when finished, will be the most complete map of that country yet published.

NORTHERN NIGERIA. Political Map on Scale of 1 : 2,000,000 or 32 miles to an inch. Compiled at the Intelligence Office, Zungeru. 1907.

Topographical Section, General Staff, London.

NORTHERN AND SOUTHERN NIGERIA. Outline Map on Scale of 1 : 2,000,000 or 32 miles to an inch. 1907.

Topographical Section, General Staff, London.

ORANGE RIVER COLONY. General Staff Map on Scale of 1 : 125,000 or about 2 miles to an inch. Sheets—125 U 11, Bothaville ; 125 U 4, Odendaals Rust. 1906. *Price 2s. each sheet.*

Topographical Section, General Staff, London.

AMERICA.

CANADA. Census Maps of the Provinces of Manitoba, Alberta, and Saskatchewan on Scale of 1 : 792,000 or $12\frac{1}{2}$ miles to an inch. James White, F.R.G.S., Geographer. 1907.

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These maps are of special interest as showing the very rapid development of Canada. On each township are printed the population figures for the censuses of 1901 and 1906 in blue and red. In the short period of five years the increase is remarkable, and great tracts of country without any population in 1901 are now covered with red figures.

UNITED STATES SURVEY. Topographic Sheets on Scale of 1 : 62,500 or about 1 inch to a mile. (The figures after name of each state indicate the number of sheets received.) Alaska, 2 ; Arizona, 2 ; California, 5 ; Georgia, 2 ; Idaho, 1 ; Illinois, 3 ; Iowa, 1 ; Kentucky, 1 ; Maryland, 1 ; Montana, 2 ; Nevada, 2 ; New Mexico, 1 ; New York, 6 ; North Carolina, 1 ; North Dakota, 1 ; Ohio, 4 ; Oklahoma, 1 ; Pennsylvania, 6 ; Utah, 3 ; Washington, 1 ; West Virginia, 6 ; Wisconsin, 2 ; Wyoming, 2. *Price 5 cents each sheet.*

United States Geological Survey, Washington, D.C.

HONDURAS. Mapa de la Republica de Honduras. Levantado por E. P. Mayes, I. C.
Scale 1 : 530,000 or 8½ miles to an inch. 1907. Price 3 dollars.
Rand, McNally and Co., Chicago and New York.

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Publishers forwarding books for review will greatly oblige by marking the price in clear figures, especially in the case of foreign books.



James O. Paul
Mine

THE SCOTTISH GEOGRAPHICAL MAGAZINE.

GEOGRAPHY AND STATECRAFT.¹

By the Right Hon. Viscount MILNER, P.C., G.C.B., G.C.M.G.,
Gold Medallist of the Royal Scottish Geographical Society.

THERE is one respect certainly—no doubt there are many others, but they are less material to the present point—in which I am at a great disadvantage compared with the distinguished men who have on previous occasions delivered this Inaugural Address. My predecessors have all been men who, either by virtue of their scientific eminence or of their practical achievements as explorers, of the earth or air, might justly lay claim to the title of Masters in Geography. I can advance no such claim; and, while I am deeply sensible of the honour of being permitted to address this learned society, I am a little frightened at my own boldness in availing myself of the opportunity which your extreme indulgence has afforded me.

My excuse must be that, if I have no right to call myself a geographer, I am at least a firm believer in the value of geographical studies, and in their educational as well as their practical value. And so I venture to offer myself as a witness on the side of your science in the controversy, which is still going on, as to its right to a place among the recognised branches of the higher learning. If that question were to be submitted to a jury of men whose lives had been mainly devoted to affairs of State, I should have no doubt as to the verdict. I do not say that the opinion of men of this class should be alone decisive, but it is at least of some value. And I am confident that there are very few of them who would not agree with me in assigning to geography, as now pursued and taught, a high place among the studies which go to make up what the Germans

¹ The Inaugural Address delivered before the Society in Edinburgh on November 13, 1907.

call *Staats-wissenschaft*, a term for which I know no exact English equivalent, but which we may perhaps translate into "Political Science" or "the Political Sciences."

Not that I have any wish to insist on including geography among the political or moral sciences as distinct from the physical—if you will forgive my using these somewhat clumsy and inadequate but still necessary labels. Indeed it is one of the strong points about geography that it is not easy to classify in this fashion. It possesses, as has been truly said by one of its votaries, a synthetic value, or, to put it in simpler language, it forms an important link in the great chain of knowledge, and constitutes a meeting-point of the moral and physical sciences. It is one of the corner-pillars, if I may so express myself, of the Temple of Knowledge. You have only to think how closely it touches geology, and for the matter of that, botany and zoology also, on the one side, and history on the other. If I confine myself to-night to one of its aspects, I must not be thought to ignore or undervalue the others.

So much to prevent misunderstanding. And now only one more prefatory observation. The claim which I think geography can confidently advance to-day to an honourable and important place among the sciences could perhaps not have been advanced with anything like the same force one hundred or even fifty years ago. For the right of any study to such a place depends, I take it, on two things: the importance of its subject-matter, and the manner in which the study is conducted. Now as to the importance of the subject-matter of geography there could never be any dispute. But its methods were not always calculated to command equal respect. When I think of the maps, the text-books, and, worse still, the geographical lessons of my own childhood, I recall things to which the term "scientific" could by no legitimate stretch of language have been applied. Great indeed has been the progress in the methods of geographical study during my own lifetime, though no doubt the beginning of improvement dates further back. For something like a century a series of eminent men, from Humboldt onwards, men imbued with the highest scientific ideals, have been busy interpreting and systematising the ever-increasing mass of geographical knowledge. If our own country has been especially rich in great explorers, other nations, and above all the Germans, have helped to raise the status of geography by a philosophic treatment of the new as well as the old material. And it cannot now be long before geography obtains on all hands that full recognition as a science to which its modern developments so amply entitle it.

But I am not going to attempt to trace the history of those developments to-night. My humbler task is to try and illustrate the value of geographical knowledge, and of the geographical habit of mind, in the sphere of government and administration. We have had quite recently a brilliant example of what that knowledge and that habit of mind, when wedded to history and to a practical experience of great affairs, are capable of producing, in the lecture on "Frontiers" which was delivered at Oxford some ten days ago by Lord Curzon. Or, to take another instance, which touches more nearly the field of my own personal experi-

ence, there have been few State papers published this year which rival in interest Lord Selborne's "Review of the Present Mutual Relations of the British South African Colonies." The memorandum, in which the present High Commissioner discusses those relations, is substantially a plea, and a very earnest and effective plea, for Federation. It would be quite beyond the scope of this address to examine that plea in detail, but there is one point about it to which I wish to call attention, because it is so apt an illustration of the subject we are considering to-night. The point to which I refer is the great importance which is attached, and rightly attached, in this memorandum to purely geographical considerations. The argument for Federation, strong in any case, on racial, economic, and other grounds, becomes absolutely irresistible when you consider the physical conformation of the country. I am not thinking merely of the contiguity of the several States. Two countries may be contiguous and yet sharply divided by some natural obstacle. Over and over again in history such obstacles have delayed or prevented the political union even of kindred communities. But in the case of South Africa there are no such obstacles at all. In only one instance, that of the Basutoland enclave, does the political boundary correspond to any extent with natural facts. Basutoland is bounded for more than half its circumference by formidable mountain barriers, and has in all respects a more homogeneous character than any other South African territory. But almost all other South African frontiers are, from the geographical point of view, quite negligible, indeed in some cases quite absurd. They are the result of historical accidents, not to say of political blunders; in some cases, perhaps, of justifiable political expedients, but never of physical factors of any real importance. No doubt there are striking physical contrasts between different portions of South Africa. I shall have to refer to them presently, and they greatly reinforce my argument, for no statesmanship can be successful which fails to take account of them. But they stand in no relation whatever to the political divisions. Indeed it would almost seem as if a perverse destiny had chosen to unite the disparate, as it has certainly sometimes divided the wholly similar and consanguineous, in carving out the strange amorphous lumps of territory which constitute the South African States.

In saying this I must not be regarded as contending that it is any longer possible altogether to ignore these political divisions. History has her rights as well as geography, and we cannot escape from the consequences of the accidents, the blunders or the devices of the past. "*Le mieux est l'ennemi du bien*," and in attempting at this time of day a complete fusion of the South African States, even assuming such a fusion to be desirable, statesmen might easily imperil the success of that strong movement towards closer union which, wisely directed, is bound to be productive of most beneficent results. But I will say no more on this point. To do so would be to allow myself to be drawn into a political discussion wholly alien to my present object. That object is merely to consider some of the most striking physical idiosyncrasies of South Africa, and to consider them as illustrating the necessity of constant close attention to the geographical factor on the part of statesmen.

I fear that the limits of my time will hardly allow me to do more than take a very cursory glance at those idiosyncrasies, and that my theme may suffer in intelligibility and in interest from excessive compression. But there are at least a good many of my hearers who will be able to fill up from their own knowledge some of the many important features of the landscape which I must pass by unnoticed in my breathless dash from the slopes of Table Mountain to the southern shores of Tanganyika. For that, and nothing less, is the extent of territory which has to be passed under review. I see that that distinguished traveller, Mr. E. F. Knight, in his recently published book on *Over-Sea Britain*, defines South Africa as "all Africa to the south of the Congo basin." I do not know that in a strictly geographical sense that is not rather too liberal a definition. To my mind the southern edge of the basin of the Zambesi is a better dividing line, from the point of view of physical conditions, than the southern edge of the basin of the Congo. But there can be no doubt that, politically and administratively, South Africa does at present straddle on right up to the latter point. And this, indeed, is one of the greatest drawbacks of British South Africa—its unmanageable shape, the great interminable wedge driven from south to north into the heart of the continent with such inadequate outlets to east and west. You go from latitude 34° to latitude 8° , from a climate of South European mildness to the heart of the Tropics, a distance of more than two thousand miles; but for three-fourths of the distance on one side, and for more than two-thirds on both sides, you are flanked by foreign states. Where was geography when we refused to look after Namaqualand and Damaraland, and did not think it worth while to give thirty thousand pounds for Delagoa Bay? The courage, the enterprise and the farsightedness of individual Britons have indeed done wonders to counteract the laches of national policy. Livingstone, Rhodes, John Mackenzie—to name only the foremost—have left their mark upon the political map of Africa to a far greater extent than even the ablest and most energetic officers of the British Crown. But the shouldering of national responsibilities by private citizens, however splendid as a display of human courage and energy, is not without its drawbacks. Our vast South African dominion bears in its configuration, no less than in its haphazard administrative arrangements, the traces of the unscientific spirit in which Governments have trifled with the problems which only systematic governmental action can adequately solve. The extension of British authority from the Orange River to Tanganyika has been accomplished by the most extraordinary series of makeshifts in the history of the world. Many of the resulting tangles will, no doubt, be straightened out by federation, when it comes. But, behind the question of the federation of British South Africa properly so called, complicated in itself, yet at least engaging the thoughts of all the ablest men whom the country possesses, lies the question of the future of her vast tropical annexe—not *South Africa* at all in a geographical sense, though now administratively tagged on to her—and that is a matter to which no one, whether in South Africa or in Great Britain, seems disposed to give the slightest attention. Yet for geographers it is surely full of interest.

The causes which have led to the phenomenally rapid advance of the outposts of Empire in Southern Central Africa and the consequences involved in it are so striking an illustration of the interaction of geographical and political influences that I venture to direct your attention to them for a few minutes.

The dominant physical fact about South and South-Central Africa is the great irregular tableland which constitutes so large a portion of it, and which carries the climate of the temperate zone into the heart of the tropics. The great average elevation of the country, with its vast stretches of undulating but not often mountainous high land, is the cause of most of the distinctive features of its life. Historically, economically, politically, nothing is really intelligible as long as the significance of that primary fact is not fully grasped. In South Africa men of European race thrive and multiply exceedingly in latitudes which are generally fatal or debilitating to the white man. Their splendid physique is due to the bracing air of these large expanses of lofty open country. But inasmuch as the high tableland is not the whole of South Africa, but is flanked and intersected by regions of lower altitude, which are tropical or sub-tropical not only in latitude but in climate, the white race is here inextricably intermingled with coloured races, equally prolific, equally at home in the country, which show no signs of succumbing to the European impact. Indeed in one respect the Bantu tribes, or at any rate the finest of them, have the advantage over men of European origin, for they seem to flourish alike in the lower and the higher altitudes; whereas, except in the extreme south, the white man is never at his best on the low ground. From this intermingling of alien races, ranging from the most highly civilised to the almost barbarous, have arisen social and political problems of the greatest complexity, and all South African history is woven on that woof.

But I must not be led astray by the innumerable topics of interest which the high plateau suggests. My present concern is with a single feature of it—the fact, namely, that it is most easily ascended from the southern end. Even the central and northern portions are, as a rule, more accessible from the south, despite the greater distance, than they are over much shorter distances from the east and west. For from the west, though the slopes are favourable, the intense aridity of the country makes progress difficult or impossible, and on the east there is a tremendous mountain barrier to be climbed. No doubt that barrier is not and never was impassable, and in recent times it has been crossed by no fewer than three lines of railway, the existence of which will greatly affect the course of future development. But even with the railway, and much more before the railway, the approach from the south was incomparably easier and more natural than from the east. It is like the difference between climbing a steep ladder and walking up a comparatively easy flight of steps. Add to this, the fact that the European settlers of the south had their base in a favourable climate (for only on the extreme south and south-west is the low-lying coast-belt temperate and healthy for men of white race), while the European settlers on the east had their base on a hot and humid shore. And bear in mind,

further, that the settlers of the south belonged to sturdy Teutonic races, in whom the tendency to expansion was still strong, while the settlers on the east, if they could be called settlers at all, belonged to a small nation in which, despite its glorious past, the exploring and colonising impulse was exhausted.

There you have, of course only in the broadest outline, the causes which led to the colonisation of South Africa from the south, the forward pressure of European immigration, if I may so express myself, on vertical rather than on horizontal lines. It was up the series of lofty terraces which lead from the south and south-west to the centre of the great plateau that Europe first invaded South Africa, and then spread, as it is still spreading, its colonists to right and left over the most eligible portions of it. It was a great continuous northward movement, no doubt with a considerable lilt, especially in its early stages, to the east, that is to the better watered and therefore more fertile side of the tableland, but still in its general direction a broad wave sweeping steadily towards the Polar Star. On and on, "with painful steps and slow," went the pioneers of European civilisation, until they could just discern on the far horizon the constellations which had shone over the heads of their fathers in their ancient home—strange constellations to most of them who had looked up since infancy at Achernar and Canopus and the Pointers and the Southern Cross.

At first, as I have said, in the days of the ox-waggon, the movement was very slow. It took two centuries before the most northerly outpost of continuous European settlement had reached the edge of the tropics, and even then that settlement was very thin and partial, with great bordering expanses of wilderness or of barbarism, and with long distances between the principal centres of population—all circumstances tending to estrange the settlers from the old European lands, the cradles of their race, and even from one another. But the great point is that by the middle of last century, just two hundred years after Van Riebeeck had established the first permanent settlement at the foot of Table Mountain, the invasion from the south had got a real grip of the centre of the great tableland and was twelve hundred miles on its way to the heart of Africa, while the European planters in the east had little more than a nominal hold even of the coast-land and had made no impression on the elevated interior of Africa at all.

And then came the railway, by far the most potent of modern inventions in transforming the life of mankind, potent and revolutionising everywhere, but most of all in thinly peopled and newly settled countries, and, among these, of incomparable potency in South Africa owing to the vast distances which separate its chief centres of European settlement, and to its almost total lack of navigable waterways. Great as is the influence of the iron road everywhere, and innumerable as are its effects, there is no portion, I believe, of the whole habitable globe in which its importance, compared with that of all other factors, is so great, so overshadowing, as in South Africa. But for the first twenty or thirty years railway development in South Africa, which then moved at a snail's pace compared with the tremendous rush of recent years, was busy in

linking up the coast ports with comparatively near and long-established inland places. If it followed the course of northern expansion at all, it followed it at first for a special reason, namely, in order to get at those centres of mineral wealth which happened—a most momentous fact—to be situate far inland, far to the north, right on the line of that advance of which I have been speaking. And so it came about that when, some five-and-twenty years ago, the great scramble for Africa began; when the European nations which were already in possession of long-neglected strips of the African coast woke up, and fresh European nations dashed forward to secure the yet unappropriated parts of it; when one and all, old occupants and new comers, began to push on their boundaries with might and main from every available starting-point, until they met and not infrequently collided in the centre—at this critical juncture the railway from Cape Town was already at Kimberley, upwards of five hundred miles on the way to the north, and, more important still, on the crown of the tableland, with the great gradual climb already accomplished, and hundreds upon hundreds of miles of comparatively level going in front of it. By virtue of that railway, coming from the oldest British port and passing in its whole course through settled British territory, Great Britain had a big start in the race for Southern Central Africa, just as by virtue of her occupation of Egypt she had a similar start in the race for the Northern Central regions, which contain the head-waters of the Nile.

Continuous settlement for twelve hundred miles from south to north and a railway, not indeed so far advanced as that, but still far advanced, and above all, having overcome the chief difficulty of all railways from the coast to the centre of Africa, the great climb; these were the advantages which the owners of the southern littoral possessed as compared with those of the eastern and western coasts in their converging movements towards the centre of the sub-continent. And thus British authority was pushed forward from the southern extremity of Africa up more than a third of its whole length before other Powers, advancing from the east and west, brought their frontiers together in front of it and so finally barred the road for any further advance. From Cape Town to the furthestmost point of North-Eastern Rhodesia is more than two thousand miles as the crow flies, and I need not say how many more as the traveller has to go. But the whole breadth of Africa at that point is only about seventeen hundred miles, and the distance from the borders of North-Eastern Rhodesia to the nearest point on the sea-coast is only about four hundred. No doubt it is true that this distant protruding spur of our vast South and South-Central African dominion has been approached rather from the east, by the Zambesi and Shire Valleys, than up the central plateau. But it is also true that our authority in that corner would hardly have been established, and could with difficulty be maintained, if the country between the four lakes Nyassa, Tanganyika, Bangweolo, and Mweru were not connected at its south-western angle with that huge oblong block of British Colonies and Protectorates and Spheres of Influence which now stretches from Cape Town to Katanga. And to the boundary of Katanga at any rate we have got by the direct

northward movement, though the distance thither is just twice as far that way as it is from either the eastern or the western coast.

That is the story in its simplest form. Of course in its details it is vastly more complicated. And there is one detail of such importance that even in this hasty review I must just refer to it. When the scramble for Africa began in the early eighties Great Britain, owing to past misunderstandings and mistakes, and to a policy which, among other things, ignored geography, and tried to separate the inseparable, had lost control of the more important—eastern—half of the northward march of European colonisation, and its most advanced posts were no longer on British territory. In 1882-83 the Boer Republic on our right flank had pushed far ahead of the furthest limit of British authority and was some four hundred miles nearer to the centre of Africa. And the fear was that foreign Powers, availing themselves of the split between Boer and Briton, might use the Transvaal to bar the road to the further advance of British influence and civilisation. It was under the impulse of that fear that Rhodes made the great dash, or rather the series of great dashes, to the north, which have resulted in the extraordinary elongation of the British portion of South Africa.

First came the march of the pioneers into Mashonaland in 1890 which interposed a belt of British settlement between the northern Transvaal and the Zambesi. Then followed in 1893 the Matabele War and the subjection of the whole country up to that river. These events gave us the great region now known as Southern Rhodesia. But Rhodes could not rest content with the boundary of the Zambesi. He was haunted by the thought of the rapidity with which all the vacant spaces of the world were being appropriated by one European Power or another, and he was bent on preserving as large an area as possible for his own countrymen. And so, before his death in 1902, despite failures of his own seeking and interruptions for which he was not to blame—despite the Raid and the Rinderpest, the Matabele Rebellion, and the great Boer War—he had succeeded in acquiring certain large trading and administrative rights beyond the Zambesi up to the very confines of the Congo Free State, and in inducing the British Government to throw its aegis over them. These are the countries now known as North-Western and North-Eastern Rhodesia, and, like Southern Rhodesia, virtually incorporated in the British Empire, though no doubt in a much more rudimentary stage in respect of development and administration. It had taken more than two hundred years to carry European authority from Cape Town to Kimberley. It took less than twenty to advance it from Kimberley northwards to a distance twice as great—a colossal achievement which we owe to the energy, the daring, and the geographical imagination of a single man.

And all the time the railway was being pushed forward with unexampled speed, as it has been since his death—not much less than a hundred miles a year on an average. Indeed, without the railway following close behind, anything like effective occupation would have been impossible. It is the fashion just now to decry the rapid extension

of railways through these thinly peopled and as yet unproductive regions, and to condemn them if they do not pay in a commercial sense. And no doubt the railways of Rhodesia, though they have been constructed with remarkable economy, will be some time before they can stand that test. But then it is an absurd test to apply to railways in a country where there are no other means of communication, where they are the only roads, the indispensable conditions alike of economic progress and of civilised government, where they are creating the development which it is their ultimate destiny to serve. Were the Roman roads expected to pay in a commercial sense? If railways were never to be built into the wilderness, the wilderness would remain what it was for all the centuries before railways were invented to conquer it.

And now perhaps enough has been said to enable us to make a fair estimate of this latest stage in the European invasion of Africa from the south, to realise the causes of its feverish haste, the boldness of its conception, and at the same time its inevitable defects. It has been a movement along natural lines, but unduly accelerated by accidental political causes. But for the scramble for Africa, even the restless genius of Rhodes might not have gone so fast or so far. And while it is impossible not to admire the spectacle of this private citizen—for after the end of 1895 he ceased to be even Prime Minister of the Cape—undertaking and financing a great enterprise of State, ensuring the concurrence of a reluctant Government by saving it all expense, and paying his way by a mixed appeal to the speculative instincts and the patriotic ambitions of his countrymen, it is no disparagement to him to say that this is not the best imaginable way in which an Empire can be built. He followed the only lines possible under the circumstances. He spent his life in the task. Our gratitude is due to him for the vast opportunities which he created or preserved for us. But Southern and Northern Rhodesia alike will long bear the traces of the strange expedients which had to be adopted in getting them started, and a great many problems will have to be solved before either of them can be satisfactorily fitted into the framework of South Africa or of the Empire.

On the future of Southern Rhodesia I have no intention to dwell. By however complicated a process, it is bound some day to become a part of self-governing South Africa. But its great tropical annexe presents features of different character, and sooner or later we shall have to apply Mr. Haldane's prescription and do a little thinking about them. And when we do, a strange tangle of interests, and a difficult choice of alternative courses, will come up for consideration. First of all there are native rights, and in one part of the country at least—in Barotseland—the yet surviving, if truncated, authority of a native monarch who is one of the most meritorious of his kind. Then there are the commercial and administrative rights of the Chartered Company, the real rulers of the land. But they are not absolute rulers, for the Imperial Government has, through the High Commissioner, very wide and substantial if somewhat indefinite power of control. And lastly,

there rises in the distance the vision of a Federated South Africa, which may wish to sweep away all of these, and to govern the whole region free from any interference, as Tombuland and Pondoland are governed by Cape Colony, and as Zululand is governed by Natal.

And no doubt there is much to be said for this solution, which is likely to commend itself, when the time comes, to any British Government, because it would be such a saving of trouble. But there is also much to be said against it, especially from the South African point of view. If I were a South African statesman there are certain considerations connected with the gravest of all South African problems which might give me pause. South Africa has got her own native population to digest. It is not that they are absolutely so very numerous. The country could easily carry a much larger population, not only of whites but of blacks, and would economically, at least for the present, be all the better for a greater supply of black labour. But if not absolutely very numerous, they at any rate greatly outnumber the whites, and they are increasing, to all appearance, quite as fast. Can it be to the interest of South Africa to annex to herself another great region peopled wholly by blacks, and thus permanently to increase the disproportion of the two races within her confines? It may be said that the healthy high plateau continues beyond the Zambesi, that white men will be able to make their permanent home there in appreciable numbers, and that therefore the distinctive features of South African life will be reproduced in those distant regions, and the whole country from the Southern Ocean to the Congo basin assume in time a more or less homogeneous character. For my own part, I greatly doubt the likelihood of such a result. The power of altitude to counteract the effects of latitude is an interesting question about which no man can as yet afford to speak very positively. I can imagine a Johannesburg on the Equator. I think it quite possible that there are in British East Africa considerable tracts which will carry a permanent white population. But one has yet to be satisfied that, with the exception of a few favoured spots, the same can be said of North-Western or North-Eastern Rhodesia. They seem rather to present the distinguishing features of a tropical colony or plantation, and such a colony is ever an ill-assorted yokefellow for those of the European self-governing type. Southern Rhodesia, or at any rate a certain portion of it, is already on the border-line between the two. Northern Rhodesia seems decidedly to cross that border-line. The present association of the two appears to be in the nature of a political accident or makeshift and not to be based on essentials. If that is so, it would not appear to be inevitable, it may even be thought unnatural and undesirable that, when Southern Rhodesia is drawn, as she ultimately must be, and ought to be, into the South African group of States, she should carry her northern annexe along with her.

On the other hand, there is no doubt the question of access. The region beyond the Zambesi is only accessible to us either through foreign territory on the east or through what will presently be a self-governing Dominion, like Canada, Australia, or New Zealand, on the south. There would be something anomalous in the position of a Crown Colony or

Protectorate which could not be reached directly from the sea or from some region of similar status to its own. Moreover, the railway which will ultimately traverse this country from end to end is a continuation of the great Trunk Line of South Africa. There are thus, no doubt, considerations of great weight on either side, and we have perhaps cause to be grateful that, for the time being, Rhodesia is still in the possession of the Chartered Company, and that there is no need to settle the difficult question of its future distribution and administration in a hurry. The system of extending the bounds of Empire by the agency of Chartered Companies is open to many objections. There has been much in the methods of this particular Company, especially during its earliest years, which it is impossible to regard with approval. But the British South Africa Company has at least two great claims on our gratitude. It has kept a large and valuable portion of the Dark Continent under the British flag, and it has built up, in a remarkably short space of time, an administration which, if far from perfect, is at least competent, honest, and humane. Government by means of a company is necessarily a transient form of government. But in the case which we have been considering, it is a valuable stop-gap, valuable in maintaining a tolerable condition of affairs and affording time to work out with deliberation, and with a fuller knowledge than we yet possess of all the conditions of one of the least explored of habitable lands, the best permanent arrangements for its welfare.

And now I see that, starting from certain wide general considerations, I have been led to dwell, at perhaps excessive length, on a single, limited, and remote, though not unimportant or uninteresting, problem. But I venture to hope that in my method of approaching it I may to some extent have illustrated my main proposition, which is the inextricable association of your science with the art of statesmanship, and that in any views which I have propounded or suggested, be they right or wrong, I may at least not have offended against the spirit of scientific geography.

THE STUDY OF THE WEATHER AS A BRANCH OF NATURE KNOWLEDGE.¹

By MARION I. NEWBIGIN, D.SC. (Lond.).

(*With Illustrations.*)

IN endeavouring to suggest to you methods of studying the weather in schools as a part of nature knowledge, it may be well to begin by considering very briefly the aims which should inspire a course in nature study, for our methods will be naturally largely influenced by our aims. The object of such a course is, I take it, twofold. We want in the first

¹ A lecture delivered to a class of teachers in connection with the University of Aberdeen on May 11, and also at the Outlook Tower, Edinburgh, on October 30, 1907.

instance to train the powers of observation and develop the intelligence, with the view not only of making better citizens, but also of increasing the happiness of life ; and in the second place we want to give an insight into the methods of science. To show that the methods of science are everywhere in essence the same, and to suggest that, owing to the fact that the further scientific research is carried, the more obvious it becomes that nature is orderly and uniform, and that there are therefore few series of phenomena too trivial to be worth study by some one—these in my opinion are points of great and increasing importance. Again, even elementary education is incomplete unless it succeeds in imparting some flavour of real enthusiasm for science, and that for two reasons. First, because the time when scientific pursuits could be regarded as a luxury for the few has passed, and the stability of the modern community depends, literally and absolutely, upon a widespread sympathy with the aims of science, if not upon a widespread knowledge of its contents. We must “educate our masters” if we are even to hold our position as a nation. The conditions of modern life make it impossible for the scientist, even if he would, to hold himself contemptuously aloof from the rest of the community ; he must explain himself sufficiently to justify his continued existence. As a mere matter of domestic policy, nature study in schools is thus justifiable. In the second place, we have also to remember that with cheap literature and the spread of public libraries, the results of scientific research are becoming available to the general public in a way to which in past generations there was no parallel. Take for example the case only of a public library. In Edinburgh, not so many years ago, in spite of the abundance of scientific societies, the great bulk of the citizens might live and die without ever having seen a purely scientific journal, hardly perhaps even a purely scientific book. Now they are taxing themselves in order that on the tables of the Reference Room of the Public Library all the leading scientific journals may be spread out, and that the shelves of that library may contain a good selection of modern books of science, which are there not only for the use of the citizens, but for that of any sojourner within the city. Surely no child, therefore, should be permitted to leave school without a knowledge of the alphabet of science, without some appreciation of the value of the heritage to which he has been born and of the best ways of utilising this heritage. If, as we are beginning to realise, the town child should have a general knowledge of his native town, of its buildings, its traditions, its mode of government and so on, he should surely have also some knowledge of the patient, continuous, self-denying work being carried on there and elsewhere in the name of science. Even from the purely scientific point of view this is desirable ; for example, there can be no doubt that if the last generation of citizens had been rationally trained in the study of the weather, the Ben Nevis Observatory would never have been closed.

If, however, I am right in thinking that our aim in nature study should be rather to arouse interest than solely to instruct ; if we are to look to the future rather than to the immediate school life, we reach the important corollary that we must from the first resist the temptation to

be thorough. Personally, I should be disposed to say—don't be afraid to be scrappy. We may lay it down as an axiom that it is not possible, even if it were desirable, during the short school life, to teach botany, zoology, astronomy, meteorology and a dozen other sciences properly, and one should be very careful not to make the attempt. Be content to open doors, to give peeps of attractive vistas. Personally, I am sometimes appalled on reading the innumerable little books on nature study which appear in such numbers nowadays, and in reflecting on the risk which an incompetent person runs of utterly sickening his pupils with such books. One wants to aim simply, I think, at giving the child the impression that there is a great deal of interest in, for instance, the weather, or the common plants, and if possible—and on this I should lay great stress—of at least hinting at the means which exist for the further study of these subjects in the form of local or general societies, of reference libraries, of museums and so forth, so that if possible, at the critical stage when compulsory school attendance ends, the pupil may have interest enough to read or to observe for himself. But above all things, I should say, beware of attempting to gather fruit, in the form of examination results, before there has been time for a full root-development.

When we come to practical detail, I suppose most of you, as practical teachers, have felt that the supreme difficulty is to find what we may call a jumping-off point. I heard the other day an interesting story of a little girl who objected strenuously to going to school because, as she said with much force, "They don't teach me anything I want to know." This is probably a condition that frequently occurs, but in the teaching of such subjects as arithmetic and spelling we have behind us the driving force of parents and relatives, who say, with a truth that even the child recognises, that adult life is impossible without a certain amount of knowledge. In nature study in general we have not as yet this advantage, and have even to allow for the fact that the parent in the background is probably saying, "Tadpoles and dandelions are all very well, but that won't help you to earn your living." It is therefore very important to include in the course subjects about which the child does want to know, in which there is an initial interest to help us over the drag at the start. Now the weather is our basal subject of conversation, interests us at every turn of life, and as even the child feels this interest, the subject is one well worthy of the attention of teachers of nature study. Again, the uncertainty of our weather has become a proverb, the difficulties of forecasting not less so, and yet when we study weather in detail we find that, although we can say very little as to the possible weather next week, and almost nothing as to its probable course next month, yet the annual series of changes which make up the climate of a locality take place in orderly sequence, and almost all the elements of the total are more or less fixed and constant. The fact that from one point science means the finding of order in apparent chaos may thus be well brought out. One must not also forget that the child is eminently practical and utilitarian, and we are not only all naturally interested in weather, but in a maritime country it is of great practical importance. In a coast town like Aberdeen one has the coastguard stations as an

evidence of this practical interest, and one can even hope to show that coastguard station, *Nautical Almanack*, and Meteorological Society form a sequence, illustrating the fact that science is merely enlightened and developed common sense and common experience.

How should we begin to study the weather? One would naturally, I think, begin with the common facts of daily experience, and would point out that what primarily interests us is the changefulness of the meteorological conditions. The temperature may be high to-day and much lower to-morrow, the air may be calm one day and in rapid movement the next, dry at one time and saturated with moisture at another, while the sky may be clear or covered with the clouds which portend rain. In other words, the most obvious variations are those in the temperature, the humidity and amount of movement of the air, and in the condition of the sky. Of these variables, one which can be very readily observed is that of the *direction* of the wind, and our senses enable us also to appreciate with a certain general accuracy its *amount*. Two facts, then about British weather it is very easy to observe, first, that calms are somewhat rare, or in other words that our climate is predominantly windy, and second, that winds of a westerly direction predominate. The direction of growth of trees in exposed situations, the arrangement of shrubberies, etc., in parks and gardens, our common use of the term "west end," to mean the part of a town which is relatively smokeless, and thus to windward of the factories, are all ways in which one can drive home this fact. I need, however, hardly say that the class should be allowed to draw the deduction that west winds are commonest for themselves, on the basis of their own observations, before one proceeds to point out how it lies at the base of much of our common life.

Again, it is easy to lead the class to see that the air is in spring at least colder with an easterly than with a south-westerly wind, that our heaviest rainfalls usually come with westerly winds, and thus to prepare the way for the conclusion that there is some connection between the different phenomena which make up the series we call weather. Very little observation will, however, show that although the variables are connected, the connection is not very close. It is more likely to rain with a high wind than with a light one, the rain will probably be heavier if the wind be westerly than if it be easterly, a south-west wind means generally a warmer day than a north-east one, and so on: one can draw up a series of probabilities, but they will not be more than probabilities. There is some connection, but not a very close connection, between these different factors, and the probabilities point to the conclusion that there is some other variable element which we have not considered which is affecting all the others. This element is of course pressure, and one should, I think, endeavour to drive home the fact that while, within reasonable limits, our senses give us no information as to the variations of pressure, yet these variations when measured by a barometer give us more information about the probable course of the weather than any direct observations we can make. To put the matter in another way, man, ever since he was man, has watched the sky and the clouds, has noted the direction of the wind, has distinguished between cold and heat,

dryness and damp, but not until the invention of the barometer could he find a rational connection between these different phenomena. *Now* the most weather-wise individual without a barometer is no match for one less sagacious, but furnished with the information which that instrument only can give. Without labouring detailed explanations of the barometer, I should be disposed to tell stories of Toricelli and Pascal, of de Saussure on Mont Blanc, and of the latest Arctic and Antarctic explorers, in the hope of stimulating the imagination, of driving home the great truth that before so commonplace an occurrence as the flying of storm-cones at a coastguard station can take place, countless generations of men must have lived and worked. Our nature study does little if it does not make clear into how great a heritage every child of a civilised nation is born, if it does not drive home the lesson that not only the great men but all the unknown generations of patient toilers have, in their degree, contributed to build the temple of knowledge, have helped to make life easier for us their heirs.

Some form of barometer is so common an article of furniture that there should be no difficulty in arranging that some members at least of the class should read it every day and record their readings over considerable periods of time. Where this is feasible I should be disposed to recommend that the pupils, at least sometimes, be induced to go and read the barometer at a coast-guard station, or at any other place where there is a publicly exposed instrument, for this adds greatly to the importance of the readings in their eyes. It is a very simple matter to plot the readings on squared paper, so as to obtain a curve, and the pupils should be made to add to each day's readings a note on the direction and amount of the wind, the condition of the sky, occurrence of rainfall, and so on. I show here three sets of readings chosen for three periods during the last winter. The figures are taken from the meteorological maps furnished by the Meteorological Office daily to the *Times*.

I have taken first the period from Sunday, January 6, to Thursday, January 10, inclusive (Fig. 1). It will be remembered that this was a period of fine dry weather which followed the stormy period with which the year opened. As the diagram shows, the barometer varied during the time from 30.1 inches to 30.3. Now, as I have shown in the diagram,

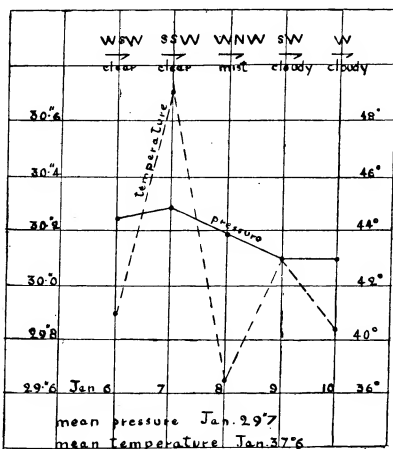


FIG. 1.

the mean barometric pressure in Aberdeen during January is only 29.7 inches, so that the barometer was high during the period, and varied comparatively little, though on the whole it was falling. During the whole period the winds were light, swinging to south and to north of west. Further, if we had allowed the children to add notes on the temperature as determined by their own feelings, we should probably have found that while they were all agreed that Monday, January 7, was warmer than usual, and Tuesday, January 8, was much colder, the opinions about the other days would vary. This would naturally lead to the deduction that though we can estimate temperature by our senses, yet our estimates have only a very generalised accuracy, and that they require to be checked by a thermometer. This can be bought so cheaply that there is no excuse for not having one outside, to be read in connection with the barometer. If the readings of this were added to the barometric readings, and compared with the mean, we should at once perceive that the temperature had been high throughout the week, and that it was highest with a south-westerly wind and lowest with a north-westerly wind. This would naturally lead to the display of an

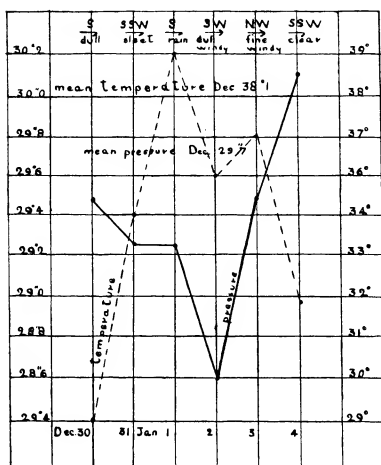


FIG. 2.

To compare with this period I have taken another period just preceding it (December 30 to January 4), which illustrates quite another type of weather (Fig. 2). Throughout this period the barometer first dropped rapidly and then rose suddenly. As it dropped the thermometer rose, and as it rose the temperature fell. With the low barometer stormy winds occurred, and the week was also distinguished by precipitation, which took the form of sleet, snow, rain, etc., according to the tempera-

orographical map of the British Islands, and the demonstration of the fact that in order that the south-west wind may reach Aberdeenshire it must blow over not only the warm seas to the south, but also over the high ground of the Grampians. As the moving current of air rises over these mountains it expands, cools, and precipitates much of its moisture; as it descends from the crest to the low ground it is warmed and dried by compression, and therefore the winter temperature of Aberdeenshire, where south-west winds largely predominate, is higher than it would otherwise be. In other words, the wind sweeps down from the Grampians with something of a foehn effect.

ture. A point to which one would draw special attention is the fact that the boisterous winds veered from south-west to north-west, and then as the stormy period passed by, swung round to south-west again.

At the risk of wearying you I add a third chart illustrating a different series (Fig. 3). During the period January 21-25 the barometer was very high throughout, but you will notice here that, while the temperature fell with a rise of pressure, it fell still further towards the close of the period with a fall. This brings out the fact that there is no necessary direct connection between changes of pressure and changes of temperature. In this period winds with an easterly component occurred, and these were accompanied by a comparatively low temperature. An interesting fact is the occurrence of a comparatively low temperature on January 24 accompanied by a south-west wind, usually our warmest wind.

Observations of this kind should be taken over a considerable period, and the scholars should be taught to plot them after some fashion similar to that shown. As shown on the diagrams, pressure and temperature may be plotted on the same square, and notes on wind and the state of the sky added. As to the deductions to be drawn, the first and most obvious is, of course, that a high, steady barometer means settled weather, accompanied by light winds and little precipitation. With such a barometer the temperature may be high in summer and unusually low in winter and spring, but this varies much with the quarter from which the wind blows. On the other hand, a low or changing barometer means unsettled, more or less rainy weather, often with strong winds. It is easy to show that the greater and more rapid the drop the stronger the wind, and that frequently a heavy rainfall precedes the drop of the barometer to its lowest point, and precedes also the development of stormy winds. It is also not difficult during much of the year to find periods which exemplify the fact that, while a high barometer is often a steady barometer, varying little for several days, a low barometer is always unsteady, and the greater the drop the more rapid the return to a more normal position.

It must always be a question for the individual how far it is necessary to explain the meaning of the barometer and its graduation, but in my opinion it would be a great mistake to do this at too early a stage. After a good many curves had been constructed it would of course be

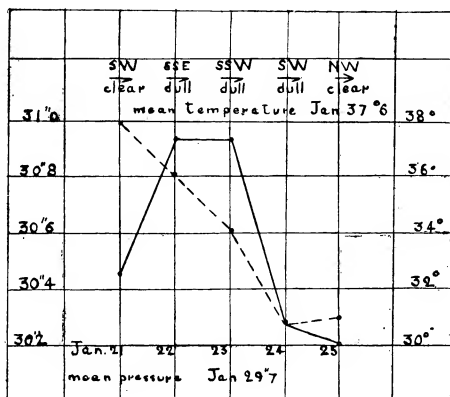


FIG. 3.

easy to explain the meaning of the term "mean height," and one might draw a line across the page to show the mean height for the month or for the year. The annual mean for Great Britain being 29·9 inches (Aberdeen 29·85 inches) it is convenient to allow the children to regard all pressures much below 29·9 as low, and all those much above as high. In addition to the obvious points named above, one might without difficulty get them to see that winds with a westerly component are by far the commonest with us, and that generally the south-west wind, which is a comparatively warm wind, is commoner in winter, while in summer the cooler west or west-north-west wind tends to predominate. If the observations are begun in winter it is also not difficult to show that frequently, though not invariably, in stormy weather the wind veers from south-west to north-west, and back to south-west when the storm is past, and that a rise of temperature frequently precedes a storm, and a fall the clearing and settling of the weather.

I should be disposed to continue the observations for some time at this level, in order to accustom the pupils to take an intelligent interest in atmospheric phenomena, and to realise the basal facts as regards variations in pressure and temperature. The temperature observations should be continued long enough, in spring and autumn especially, to show the slow upward creep in spring to the July maximum, and the equally slow downward creep to the January minimum. Pressure on the other hand reaches its maximum in May or June when east winds predominate, and its minimum in the region of Aberdeen in the stormy month of January. With or without the help of actual observations of rainfall one would try to lead the class up to the deduction that, if most of our rainfall comes with high winds or storms, and these come with periods of low pressure, then the months of highest pressure will be the months of least rainfall, and the months of lowest pressure will be the months of highest rainfall. I should lay great stress upon the necessity of leading up to deductions of that kind, because, as already pointed out, the great value of the study of the weather is that it serves to show that science means finding order in what looks like chaos, and there is a widespread impression that the amount and time of fall of our rainfall are phenomena wholly outside natural law.

Sooner or later, however, one wants to go further than this, and to show in detail how the minor constantly occurring fluctuations of weather in our country are all parts of a great series of phenomena affecting vast tracts of the earth's surface.

In the first place, the analogy of the punctured bicycle tyre or the open gas tap will enable one to explain that air, or any gas when free to move, tends always to flow from a region of high pressure to that of low. With this as a basal foundation, one may allow the scholars to draw for themselves the deduction that if at Aberdeen there is a strong wind blowing, and the barometer at the same time shows that the pressure is low, then we know that the air forming this wind is flowing from some region of high pressure into the area of observation. Let us take, for instance, the conditions prevailing on January 25 as shown on the accompanying map (Fig. 4). In passing, one may point out that such a simple form of

map is readily drawn on the blackboard. Such maps are published daily in the *Times*, and also by the Meteorological Office, and a first lesson on such a map would naturally be given after barometric readings have been taken for some time. On showing the map, one would simply point out that great numbers of people have for the particular day been also reading their barometers, and that the lines are drawn through places where the pressure was equal at the time of observation. On the particular date at which this map was drawn, the pressure was high off the west coast of Ireland, 30.5 inches, and comparatively low, 29.9 inches, off the coast of Norway. The result was that a strong wind appeared off the coast of Aberdeenshire, this wind having a north-west direction. Some acute observer would doubtless at once point out that the analogy of the bicycle tyre is insufficient, because obviously the air is not moving direct from the region of high pressure to that of low. The reason is, of course, the fact that the earth is a rotating body. How

FIG. 4.¹

far it is possible to explain the cause of the resultant deflection to an elementary class is a difficult question, but it seems to me that in the first instance one should be content to emphasise the fact of the deflection. When the fact had been thoroughly grasped one might venture upon an explanation, but I should not personally be disposed to lay much stress upon it. The fact of importance is certainly that, in the northern hemisphere, if the wind is at your back, the lower pressure is at your left hand, or conversely that the wind blows roughly at right angles to a line joining the regions of high and low pressure. In other words, the wind is roughly parallel to the isobars, or lines of equal pressure. This, known as Buys-Ballot's law, should be perfectly familiar, and the class should be able to answer without hesitation such questions as:—If the pressure is low in the Hebrides and high over Denmark, what will be the direction of the wind in Aberdeenshire? If the wind is east at Aberdeen, where is the pressure high and where is it low? and so on. The matter should be returned to at different periods until all the members of the class appreciate the fact that, when they know the direction of the wind in their own neighbourhood, they know something about the distribution of pressure in the surrounding regions.

When the pupils have become familiar with rough weather charts drawn on the blackboard to illustrate the relation between pressure and wind, one would proceed to show what other points one may learn from such charts. Let us take one of those for one of the days in January which

¹ In this and the following charts, the dark wash indicates low pressure, and the lighter high.

we have already studied (Fig. 5). On January 2, a day when the wind was fresh or strong over much of the British area, we find on the chart that



FIG. 5.

the pressure at Aberdeen was only 28.6 inches, while in the south of England it was 29.4 inches. In other words, between Aberdeen and Hastings, a distance roughly of 450 miles, there was a difference of pressure of $\frac{8}{10}$ of an inch. That is, in travelling between these two places we should find that every 56 miles caused the barometer to fall $\frac{1}{10}$ of an inch. We express this by saying that on that day there was a northward gradient of $\frac{1}{10}$ of an inch in 56 miles. The result on the principles already discussed is that the wind was south-westerly to west at Aberdeen, and as the gradient is unusually steep, the wind was

almost everywhere strong. The gradient posts on a railway cutting will help to make clear the meaning of the term gradient. One would also point out that a north or north-west gradient is the commonest one in Britain, or in other words, the air is, generally speaking, piled up to the south or south-east of England, and is thinner to the north or north-west of Scotland; and the result is that our winds are generally westerly in direction, the air travelling northwards being deflected to the right owing to the effect of the earth's rotation. With the conditions on January 2 we may compare those on December 30, when the winds were light over the British area generally; the gradient was only $\frac{1}{10}$ of an inch in about 120 miles, that is, less than half that of Jan. 2, and was north-westerly rather than northerly, the result being that the southerly component of the wind was more marked. These examples serve to show that the intensity of the wind depends, other things being equal, on the amount of the gradient, a steep gradient meaning a strong wind. The weather map for almost any day will afford materials for a lesson of this kind, and will serve to drive home the fact that the local conditions are interesting, both because they are a part of the whole, and because they enable us to draw certain conclusions as to the conditions existing in other regions.

As well as drawing charts on the blackboard, the teacher may very easily show the class how to construct these by giving them a blank map of Great Britain and a few barometric readings in addition to the local one, and then allowing them to draw lines connecting the places of equal barometric height, putting in a few arrows to show the theoretical direction of the wind. If such a map is made and compared with an

actual weather chart, it will be seen that the local conditions may at any given spot considerably modify the actual winds.

When in this way we have succeeded in giving some general knowledge of the relations between the variations of the barometer and the amount and direction of the wind, we want to take some further steps in advance. Why does the barometer swing up and down? If the pressure, as a general rule, is higher in the south of England than in the north of Scotland, how is it that we have sometimes east winds in the north of Scotland? Why is the barometer sometimes steady for days, while at other times it oscillates continually? We want to encourage the asking of such questions. If the observations are begun during the colder season of the year, it is unlikely that they will be continued for long without including what the meteorologist calls a cyclone, and the opportunity may be taken for a general discussion of the meaning of cyclones. Instead, however, of beginning with a definition which would probably entirely fail to interest the class, it is, I think, possible to devise means of getting at the facts indirectly. The observations of the barometer have shown us, so far, that a falling barometer generally means wind, and a rapidly falling barometer strong wind, because the air rushes in to fill the space indicated by the low glass. Let us take the period from December 30 to January 3 as an example of a period of low and changing barometer (see Fig. 2, p. 632). You will notice that, as has been already pointed out, this was a period also of strong and changing winds. Now, on the principles already discussed, this means that the region of low pressure is changing its position. For example, on January 2 the wind was south-west at Aberdeen, therefore the pressure must have been low to the north-west of Scotland. On January 3 the wind was north-west, therefore the pressure must have been low in the region of Scandinavia. We shall find by observation that stormy periods are always periods of changing winds, and we therefore draw the first deduction that storms mean the existence of an area of low pressure which is continually changing its position. Once again, a further examination of our diagram will show that on this occasion the barometer began to fall distinctly before the storm developed itself. The drop was at first slow, and gradually increased in rapidity as the storm approached. If we had been in communication with a school on the west coast of Scotland, we should have found that the barometer there dropped before ours did, and if we had been also in communication with a school on the west of Ireland, we should have found that their barometer fell still earlier, and in both cases the earlier fall meant an earlier development of stormy winds. We might then sum up by saying that during the period December 30 to January 4 a storm swept across Ireland, over Scotland, and then across the North Sea to Norway. But we could express the same thing in other words by saying that a wave of low pressure swept over this region. Continued observation would then convince us that when there is a very low barometer at Aberdeen this is not an isolated phenomenon. As a general rule, before the barometer drops at Aberdeen it has already dropped some point to the west of us. After it has turned to rise at Aberdeen, it is still falling at some point

to the east of Aberdeen. Such moving areas of low pressure are called cyclones, and as a general rule cyclones reach us from some point to the west and travel to some point to the east. As they travel to the north-east or east, the cyclonic areas gradually die away.

The exact sequence of events may be more clearly made out by the study of the weather maps for the period. On Tuesday, January 1, a very well defined approximately circular area of low pressure lay over the west coast of Ireland, which on the two following days gradually passed over towards Norway (see Fig. 5, p. 636). Now into a circular area of low pressure of this kind the winds swing counter-clockwise, therefore when the cyclone passes to the north of the point of observation the wind will veer from south-west to north-west, returning to south-west as the influence of the storm area passes completely away. It is easy to realise that this must be so if one thinks again of Buys-Ballot's law. If the area of low pressure is to the north-west of the point of observation, then by this law the wind will be south-west. When the area of lowest pressure shifts to the north of the point, the wind will be west, while as the area of low pressure passes over to the north-east the wind naturally becomes north-west. The maps show this well, but I should urge that the pupil's attention be repeatedly drawn to the fact of its occurrence in the case of storms before one offers an explanation. If difficulty is then found in explaining the shift, the simplest way of making matters clear is to make one pupil represent the moving cyclone while another member of the class revolves so as to keep his left hand to the moving boy. The wind is always in his back. The attention of the class should also be drawn to the fact that the temperature usually rises as the cyclone approaches, and heavy rain often precedes the fall of the barometer to its lowest point. As the glass turns to rise, the weather clears, becoming finer but colder. To put the matter in another way—if the glass is steadily dropping, while the temperature is mild, it is probable that there will be rain, followed or accompanied by strong winds. These points are very easily observed. If the centre of the disturbance passes through the point of observation, then its passage may be marked by a squall accompanied by heavy rain-fall, after which the glass begins to rise. Of this, the "clearing shower" as it is called, we had some pretty examples last winter. It not infrequently happens, however, that the whole series of phenomena does not present itself in so typical a form as in the particular case illustrated. Especially in winter time it sometimes happens that one depression follows hard on the heels of another, and thus the rise of the barometer and the fall of temperature are more or less marked. If after the passage of one cyclonic area the temperature rises suddenly, then another disturbance may be expected.

I have chosen for this first example a disturbance whose centre passed very near Aberdeen, so that its effects were well marked there. But there are frequent winter cyclones which pass along other tracks and affect the Aberdeen area in quite another fashion.

I have represented an example on the accompanying diagram (Fig. 6). You will notice that on November 4, 1906, the glass at Aberdeen was

low and falling, the temperature high, the sky overcast, and the wind easterly and boisterous. On Monday, November 5, the glass had fallen much further, the temperature had fallen with a backing of the wind to the north-east and the rainy conditions continued. By Tuesday the barometer had risen and the temperature had markedly fallen with a further backing of the wind to the north-west, while at the same time the sky cleared. The weather maps show that the cause of these changes was a very well marked depression which swept up from the Bay of Biscay, affected the south of England and the Channel strongly, and gradually died away as it reached the North Sea. In this case, the area of low pressure passed to the south of the point of observation, and, as may be readily understood, on reflecting that if the left hand be made to follow the moving centre the wind will always blow on the back, the wind necessarily changed from south-east to east, north-east and finally north-west. Now in the case of the earlier observations, the point of observation was usually such that the majority of the cyclones passed to the north of the observer, and therefore the change from south-west to north-west was regarded as the normal one and was called "veering," while the other series of changes from south through east to north-west was regarded as abnormal and was called "backing." But again I should say, do not attempt such explanations until after the facts have been observed, and seize the points of human interest as the basis of the lesson. Let the pupils, for example, deduce for themselves the conclusion that when there is a big winter storm in the Channel, then the wind at Aberdeen changes from a south-easterly direction to a north-westerly one, but on the other hand, when there is a storm off the north or north-west of Scotland, the wind swings from south-west to north-west. Once they have observed this for themselves they will, I think, be delighted to have the reason shown to them.

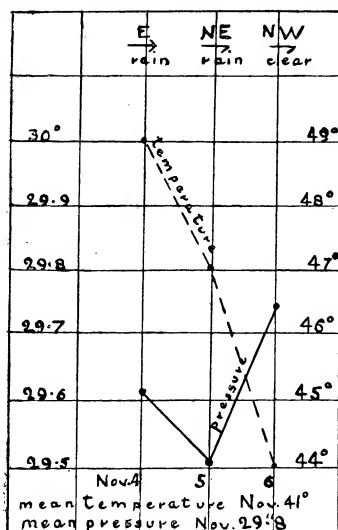


FIG. 6.

Throughout the winter months in any normal winter both types of cyclone occur only too abundantly, and the class should be taught to pick out the more distinct of them from their regular series of observations, and draw their own conclusions as to their path across the country. At the end of the winter one might show the class a storm-chart, or even allow them to construct such a chart on the basis of their own observations, to show the normal tracks of the winter storms, and

to emphasise their frequency off the west of Ireland and Scotland, in the south of England, and so on. There is of course no reason why, at any rate at first, the academic term *cyclone* should be employed at all. That a storm is in essence a moving area of low pressure into which the strong winds blow in the reverse direction to the hands of the clock, and which usually reaches us from some point of the western Atlantic, is all that is needed in the first instance. Later, when meteorological maps had become thoroughly familiar, if this stage were reached, it would be time enough to point out that while all our storms are due to cyclones, we cannot tell if an advancing cyclone is or is not sufficiently well developed to produce a true storm. Some meteorologists recommend that the pupils be ultimately allowed to attempt forecasts for themselves. Personally, I should be disposed to be content if I succeeded in suggesting how it is that forecasts are possible, to the limited extent to which they are as yet possible. The suggestion has been made for America, where the weather is perhaps somewhat more dependable than here.

One would also, of course, correlate the results both with the history and geography lessons, and point out the connection between the history of Britain and the storm-tracks which all but engirdle it, the lessons which the race has learned in those tempest-tossed narrow seas, the meteorological meaning of the Channel Tunnel scheme, which is so largely influenced by the Channel cyclones, and so forth. All these are points which would certainly interest the class, as being subjects in which their elders are also interested, and in which really important people like coastguards, sailors, and so forth are concerned.

At the close of a winter of such carefully kept observations one should be able to get the class to make for themselves a series of deductions like the following:—

We had this winter a number of storms (number stated) in which the wind veered from south or south-east to south-west and then to north-west. It was warm and rainy at first when the wind was slowly shifting from south to south-west and while the glass was falling, but when the glass began to rise and the wind went round to the north-west it was colder and drier. We had another series of storms in which the wind backed from east through north to north-west. There was not then generally so much rain before the barometer fell to its lowest point as in the other case, but after it began to rise the weather was again colder and clearer. These deductions having been made, one could by the help of weather maps say something on the general subject of cyclones.

If, by the help of a home-made rain-gauge, one had also measured the rainfall, it would be possible to make clear the fact that the rainfall is usually heavier when the centre of the cyclone lies to the north than to the south of the observer, and the other fact of interest that the greater part of our rainfall is cyclonic, that is, would give definiteness to the common fact of experience that strong winds and rain generally go together with us. One might even succeed in reaching the conclusion that, as we get most rain when the cyclone passes to north-west of us, then the wettest parts of Britain will be those which have most storms

passing them in this direction, *i.e.* will lie to the west and north-west. This fact, taken in conjunction with the fact that the mountains of Britain lie to the western side, explains the peculiarities of the British rainfall. It seems to me that once the interest of the class had been aroused in meteorological phenomena, occasional geography lessons which would bring out the peculiarities of the climates of Britain would be probably greatly appreciated.

The making of maps to illustrate rainfall, isobars, storm-tracks, and so forth, would almost certainly be found more interesting than the ordinary types, and can be done very simply, while they will be much clearer if coloured.

But though, at any rate in winter, storms are only too frequent with us, other conditions also occur. Is there nothing to observe during a period of calm, settled weather? Let us look first at a diagram for such a period constructed on the basis of daily readings of barometer and thermometer (Fig. 3, p. 633). On Monday, Jan. 21, the weather was clear, the temperature normal, the pressure high, the wind south-westerly and light. On Tuesday the temperature had dropped, the wind had gone round to the SSE., the sky was dull, and the barometer had risen to a great height. On the next day (Wednesday, January 23) with a change of wind, the temperature had dropped still further, and the barometer was still very high. The reading marked is that for 6 P.M., but at ten o'clock in the morning in Aberdeen the glass was actually above 31 inches and only slightly below the "record" for the British Isles, while during the same day it apparently reached an actual "record" in Russia. Thursday showed a very marked drop of pressure as well as of temperature, and Friday an increase of wind, a further drop of pressure, and a slight rise of temperature. Throughout the whole period, as the diagram shows, the pressure was very markedly above the average, so that until its close the conditions were what is called anticyclonic. The weather charts make clear what was actually

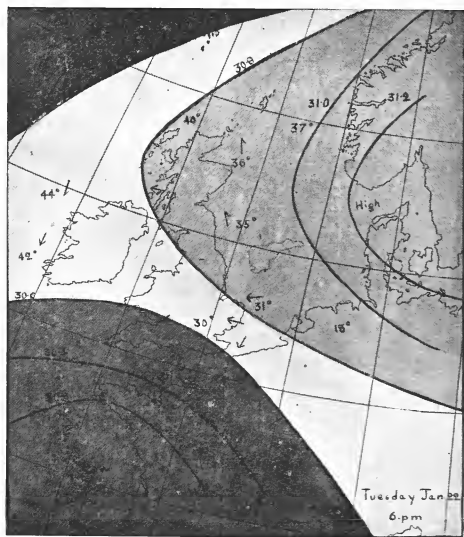


FIG. 7.

happening. On Tuesday, January 22 (Fig. 7), it will be seen that an area of high pressure embraced the south of Scandinavia, Denmark, and included the whole of Scotland and a large part of England. At the same time an area of considerably lower pressure occurred over the Bay of Biscay. Into the area of high pressure the winds were swinging in a clockwise fashion, and therefore with a prevailing eastern direction, which varied from pure east over the south of England to SSE. over the north-east coast of Scotland. Now the east wind in winter is sweeping across the cold snow-covered plains of Central Europe, and therefore it is much colder than the south-east wind which comes from the warmer parts of Europe. In consequence, you will notice that Aberdeen was then warmer than the south-east of England, and much warmer than Holland. Once again, while Scotland and the greater part of England were under the influence of the clockwise whirl of the anticyclone, Ireland and the seas off the south and west of England were under the influence of the counter-clockwise whirl of the region of lower pressure. As the gradients between the two regions are steep we find, first, that the Channel and ocean are more or less stormy, and second, because the ocean in winter is warmer than the Central European plain, and because the winds here are oceanic, that the temperatures at the west were much higher than those to the east. On the following day the anticyclone had spread more and more over Britain, pushing the area of lower pressure to the south, as it were, and the régime of easterly winds in consequence spread more and more over the south of England and over France, with the result that a wave of cold spread more and more over this region, while at the same time the warm region was being pushed to the north, so that at the Faeroe Islands it was very much warmer than at London. The temperature at Aberdeen was 34° as compared with 28° in southern England and 45° in the Faeroe region. On Thursday the anticyclone showed signs of disappearing, and the weather was influenced by the appearance of a depression to the north. The presence of areas of high pressure over the west coast of Europe and over Ireland produced, however, cold and snow over much of the British area, especially to the south.

Apart from the special peculiarities of this period, we may deduce one or two general facts as regards winter anticyclones. First, the weather chart shows very clearly that an anticyclone to the north of any given spot means winds with an easterly component, which in winter and spring are cold and dry. They are cold because of their origin, and dry because they form part of an anticyclonic or descending circulation. It is these anticyclonic winds which tend to occur especially in spring, and which, because of their dryness, produce on most people a definite and disagreeable physiological effect. Although there is a popular superstition that they are commonest in east and north-east Scotland, the position of the anticyclones in the early part of the year is such that, in point of fact, they are commonest in the south-eastern part of England. Secondly, the chart shows that if an anticyclone is to the south or to the south-east of a given spot, the winds will have a westerly component, and the cold will be less than

in places further south. In other words, it frequently happens during an anticyclone of southern position, that places to the north and north-west are considerably warmer than places to the south and south-east. I need not take up your time by pointing the effects of this fact upon the winter climate of western and north-western Britain, as compared with eastern and south-eastern areas. The diagram (Fig. 3), however, shows another point, and that is, that even apart from the east winds there is a tendency for the temperature in a winter anticyclone to be low. This is because the air sweeping out of an area of high pressure has been dried by compression, and such dry air allows radiant heat to pass through it very rapidly. During a winter anticyclone, especially in February or late in January, when the sun has considerable power, the almost windless air may feel comfortably warm during the day, but no sooner does the sun go down than rapid radiation begins, and we have the severe night frosts characteristic of winter anticyclones. The length of the winter night and the shortness of the winter day means relatively little absorption and very rapid radiation. A winter anticyclone then means clear, keen frost, with often cloudless sky and sunny days, and bitterly cold, starry nights. Further, as the ground radiates heat very rapidly, it usually happens that low-lying places, and especially narrow valleys, become clothed in a dense mantle of fog due to the cooling of the air nearest the ground below saturation point. This effect is greatly assisted by the calmness of anticyclonic weather, and is the reason why places slightly elevated above the sea and above valley floors are best suited for winter resorts.

In the same connection one might point out that because over much of the continent of Europe the winter weather is typically anticyclonic, it is clear that winter resorts in the Alps, for instance, must be mountain regions and not in deep valleys, for there is not sufficient wind to sweep away the damp fog that accumulates on the bottom of the valleys. Speaking generally, anticyclonic periods are less well marked in Scotland, and especially in north-west Scotland, than in south and south-east England, and the chart of storm-tracks gives us the reason. It shows that the climate of Scotland is strongly influenced by depressions arising from the region round Ireland, which, as it were, push away the anticyclones.

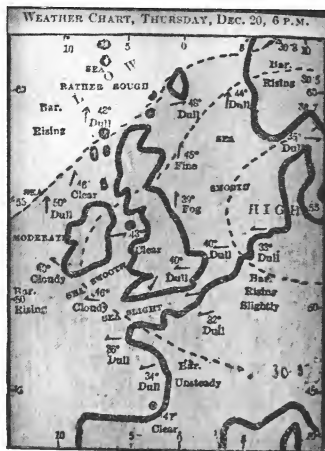


FIG. 8.

The weather chart for December 20 (Fig. 8) shows another anticyclone, and it is again interesting to note how the position of the area of high pressure is chilling down the south of England and the greater part of

France, while the western shores are comparatively warm. Again also, you will notice that Aberdeen is influenced by the western conditions, so that it is actually warmer there than in the south of England. On the other hand, on May 6, when there was a northern anticyclone over Iceland, the temperature at Aberdeen (46°) was 20° lower than that of London (66°), which was influenced by an area of low pressure over Ireland.

Somewhat different conditions are shown by the weather charts at the end of March. It will be remembered that there prevailed then over the greater part of the British area a type of warm, calm, dry and sunny weather, unusually mild for the season. I show here the chart for March 21 (Fig. 9), which has some interesting features. The chart shows that over the greater part of England the weather is under the influence of an area of high pressure lying to the south. The winds were largely west or south-west, the temperature was high, and the sky clear and sunny. Ireland and much of Scotland, especially the west, was, on the other hand, under the influence of an area of low pressure lying near Iceland, and there causing storms. The influence of the cyclone was shown in the cloudy sky, and in the lower temperature off the north-west where the winds were west or north-west. Later, the anticyclone extended its sphere of influence, so that much of the British area was embraced by it.

These examples may serve to show that the anticyclonic condition is very different from the cyclonic. While in the case of a cyclone the air



FIG. 9.

streams in from the surrounding regions to fill up the central depression, in the case of an anticyclone it is streaming gently outwards, forming light winds which sweep round the centre in a clockwise spiral. Now in the case of the cyclone the entering air rises as it enters, and is thus expanded and cooled, often below the saturation point, so that we have the characteristically heavy cyclonic rainfall. In the anticyclone the air that sweeps out of the centre is replaced by descending air, which is thus warmed and dried by compression. The result is that an anticyclonic period is a period of characteristically low precipitation. Again, while a cyclone is a moving area, an anticyclone is more or less stationary, remaining until it is displaced by an advancing cyclone. The anticyclonic periods are thus periods of settled weather and steady barometer. In detail, however, the character of the weather during an anticyclone depends greatly upon the season, and upon its position. The very cold period of predominating east winds which occurred in the middle of April was, for instance, due to the prevalence of an anticyclone over the northern part of our area.

In summer, from whatever quarter the light winds blow, they come from regions baked more or less in the summer sun. The nights are too short, in the early part of the summer, for much radiation to occur, and the long day means that the earth is baked in the welcome heat. The only disadvantage is that these periods are in summer apt to be periods of long-continued drought, for rain does not come until the anticyclone is displaced by the approach of a depression from the west. When anticyclones prevail comparatively late in the season, as in September, the rapid radiation and heavy dew at sundown is often very striking, and still later, of course, the warm days are often closed by a sharp night frost. The warm weather of the summer of 1906 was the result of a succession of anticyclones, the hot spell at the end of August being due to a well-marked anticyclonic system over western Europe. As a general rule, however, much of Scotland is less liable to anticyclones than the south of England both in summer and in winter, and as on the low ground a long-continued anticyclonic period soon becomes oppressive, we find that in summer many of the inhabitants of the south of England quit it for those parts of Scotland where they may feel the cooling effect of those slight cyclonic depressions which advance from the west and bring with them north-westerly or westerly winds and showers.

It will be seen from the above that there are few periods, either in summer or in winter, when it is not possible to give interesting lessons on the weather, and that by a judicious graduation and combination of observation and direct instruction it is possible to make the main points as regards cyclones and anticyclones clear to an elementary audience. For the sake of completeness, I should like to add a short discussion of the factors which determine the relative prevalence of cyclones and anticyclones in our area. This wider view of the subject cannot be so directly related to the pupil's own observations as the preceding, but it would, I think, afford material for occasional useful lessons. It is a fact of common experience that our winters tend to oscillate between two types:—the very cold, still, frosty anticyclonic type which, when it occurs, is almost always much better marked in southern England than in Scotland, and the stormy, warmer type when snow and severe continuous frost are rare, but when storms are frequent. Similarly, our summers tend to oscillate between the very hot, still type, with long drought, again not usually well marked throughout most of Scotland, and the more or less blustery, cooler, and more rainy type, which is more or less constant in the north-west. Now what has been already said will make it clear that this simply means, that on the whole cyclonic disturbances are more frequent, both in winter and in summer, across the northern and western parts of these islands than in the other parts. Again, if this is the case, then it is obvious that the mean barometric pressure must be lower to the north and west than to the south. I have already explained that this is so, and Dr. Buchan's maps bring out the point very clearly.¹ In

¹ See *Journal of Scottish Meteorological Society*, xi. (1898): 'The Mean Atmospheric Pressure and Temperature of the British Islands,' by Dr. Buchan.

the colder months of the year the mean gradient is north-westward that is, the lowest pressures occur to the north-westward where the cyclonic areas most frequently pass. In the warmer months, on the other hand, when the paths of the cyclones are further to the north, the gradient becomes northward, that is, the isobars run approximately east and west. In order to explain these facts and the orderly progression of our weather, it is necessary to look beyond our own narrow area to the surrounding continents and oceans.

If we take a chart showing the isobars for the eastern part of the northern hemisphere during January, a typical winter month (see Hann's *Metecorological Atlas*), we find that there is an area of markedly low pressure to the south-west of Iceland, while the pressures over the North Atlantic generally are low. At the same time the pressure is high over Asia, this belt of high pressure extending also over the greater part of the continent of Europe, except the north and extreme west, while another region of high pressure occurs in mid-Atlantic to the south-west of the Azores. It will be noted that much of the British area falls into the northern area of low pressure, while the southern part comes into the debatable area. As a result of this arrangement of isobars the prevailing wind is south-west, the winds whirling out of the mid-Atlantic area of high pressure into the Icelandic area of low pressure. We need not stop here to show that our characteristically mild winter climate is due to this predominance of warm winds in winter, but may repeat that this represents the mean condition. In point of fact our winter weather is determined by the constantly renewed conflict between cyclonic and anticyclonic conditions. The great area of high pressure over the continent of Europe and Asia is, as it were, constantly striving to spread itself over the British Islands, and when it succeeds we have calm, cold weather with slight precipitation, and sunshine or fog according to the local conditions. On the other hand, the Icelandic area of low pressure is constantly, as it were, throwing off moving areas of low pressure, or cyclones, and these travel with varying degrees of rapidity over one or other of the storm-tracks which cross the British Islands, and bring with them strong winds, relatively high temperature, and heavy rainfall. Now the passage of these cyclonic areas is favoured by an extension of the Icelandic area of low pressure over the northern part of Great Britain, and the result is that our winters swing between two types according to the extension of the areas of high and low pressure. If the continental area of high pressure encroaches upon our area we have the cold clear type; if the northern area of low pressure, the boisterous warmer type. If the details are complex this main fact is simple, and does not seem beyond the reach of even the school child.

If we now glance at a chart showing the distribution of pressure in July, we shall note some very marked differences in the position of the isobars. The area of low pressure in the vicinity of Iceland is no longer marked, but on the other hand the pressure has fallen greatly over the continent of Asia, now heated with the powerful summer sun. At the same time the region of high pressure in the Atlantic has become

more northerly in position, and much more marked. The normal wind is now that of a more westerly type, which sweeps out of the Atlantic anticyclone towards the lower pressures in northern Europe and Asia, is cooler than the south-westerly wind of winter, and has thus a markedly tempering effect on the summer heat. The uniformity of this type is interrupted first by cyclones, which in summer are usually of a mild type, often bringing the summer rainfall in the shape of thunderstorms, and at other times marked by rain and moderate winds, but only rarely by storms. At other times, as already explained, our typical summer weather is interrupted by anticyclones, producing unusual heat and drought, and lasting until displaced by some minor cyclonic disturbance from the west. Such is the usual trend of British weather throughout the year, markedly regular in its irregularities. A few words may, however, be said as to the spring. In the region of Aberdeen, as over Great Britain generally, the highest mean barometric pressures occur in spring, especially in April and May, the period also when the gradient is least. This means that in these months the weather is predominantly anticyclonic, cyclones being of minor importance. Therefore, for the reasons already explained, this is the time when we tend to have cold, dry, disagreeable east winds, but it should be clearly understood that it is largely their anticyclonic character that gives these winds their unpleasant qualities. All the characters of anticyclonic weather are often well shown in spring. We have the clear sky, with fog in valleys, especially in the evenings and mornings, the bitter dry wind, the warm sun, and the sudden drop of temperature when the sun goes down.

My aim in this lecture has been both to show what there is to teach in connection with weather, and to suggest methods of teaching it. As is the case in practically all the sciences, the great difficulty is to combine in a rational way the method of direct observation and of instruction so as to give the taught something in the way of a practical appreciation of the subject. If I may recapitulate my suggestions, I should say begin first by the most general and simple observations of wind and sky, sunshine and rain. Then introduce the barometer, and get a series of observations sufficient to answer a series of questions, such as:—does the barometer move or not? much or little? does the wind affect it? the temperature? rain? At first, at any rate, I should be disposed to let the class take observations for a school week at irregular intervals rather than continuously, and then let them compare different weeks until they gradually acquired some notion of the meaning of average height. After the interest had been aroused, it would be a good plan to give a series of more detailed lessons, and gradually introduce the consideration of cyclones and anticyclones, the reading of weather charts, and so forth. One would naturally take advantage of outstanding meteorological events as texts—a great storm such as that which wrecked the *Berlin*, a long frost, our late fine Easter: any one of these would form an interesting starting-point. As I have tried to show also, the subject may be correlated in many different ways with the ordinary geography lesson, or even with history, for climate has had much to do in making the British what they are, and climate is

merely the average succession of weather. Especially, however, I should lay stress upon the attempt to employ meteorological phenomena as a stimulus to the imagination, and I should urge the value of introducing in occasional lessons conceptions which in their entirety may be beyond the reach of the class, but of which they can be made to understand enough to greatly interest them. I have great faith in Anatole France's dictum that a child's feelings may be intensely roused by subjects which are, strictly speaking, beyond his intellectual reach. I should strive to make clear, for instance, something of the romance of a meteorological map, to picture the many patient observers, widely separated from one another, who day by day records each his quota of facts—facts whose full significance the individual cannot at the time fully see, but which he registers in the certain knowledge that they will fit into a clear and coherent whole. Man now no more than ever he could can alter the course of the winds, but within limits he has now so far conquered nature that he can tell whither they come and where they will go, he has conquered time and space so far that he can send warnings of coming changes. Here surely are facts which are worth knowing, suggestions which are worth making. Again, though the meteorological map is an extraordinary triumph of scientific skill, it has still many gaps. The meteorologist is still groping after that perfection of his methods which will enable him to prophesy without fear of error, and his science has not the frigidity of perfection, but the perennial interest of an evolving organism. In our own British weather maps so apparently a trifling matter as the opening of the cable to the Faeroes and Iceland has greatly increased the value of the forecasts.

I do not wish to claim for the study of the weather any monopoly of merit, but only to suggest that if I am right in my statement of the aims which should prompt the teacher of nature study, it is a branch which is well fitted to carry out these aims.

Teachers will find the following useful in connection with the study of weather: The chapters on British Weather and British Climates in Mackinder's *Britain and the British Seas*; *Some Facts about the Weather*, by Marriott; the publications of the *Scottish Meteorological Society*; of the *Royal Meteorological Society*; of the *Meteorological Office* (cf. this Magazine, p. 266), and also Symons's *Meteorological Magazine*. The general subject is discussed in the ordinary text-books of meteorology, as Dickson's, Buchan's, Davis's, and others.

PROCEEDINGS OF THE ROYAL SCOTTISH GEOGRAPHICAL SOCIETY.

A MEETING of Council was held on the 12th November, when the under-mentioned ladies and gentlemen were elected Members of the Society:—

Charles Ker, M.A., C.A.
W. W. Naismith, C.A.
John Armour Brown.

Horace F. Munro.
Mrs. Malloch.
James W. Drummond.

D. M. Maclay.	James Boyd.
Captain C. H. Brown.	James W. Lowber, Ph.D., Sc.D., F.R.G.S.
John Henry Luis.	A. C. S. Scrimgeour.
Farquhar Macrae, M.B., C.M.	Thomas D. Cochran, S.S.C.
Andrew D. Barnett.	T. Wemyss Fulton, M.D., F.R.S.E.
Robert L. Scott.	R. G. Watling.
W. J. K. Shaw.	John H. Stewart.
J. H. Irons.	Colin R. Crombie.
Wm. T. Oldrieve (H.M. Principal Architect for Scotland).	Charles E. Marshall.
Colonel Charles S. Noble.	Arthur Law.
Louis Liebenenthal.	Mrs. Mary H. Mcintosh.
William Sturrock, M.A.	Duncan Brown, C.M.
H. Brantwood Muff, B.A., F.G.S.	G. M. Brotherston.
J. A. S. Barrett, M.A.	Mrs. MacLaren.
Mrs. Dallas.	Wm. N. Turnbull.
A. E. Scougal (H.M. Senior Chief Inspector of Schools).	Mrs. A. F. Imlach.
Frank W. Michie, H.M.I.S.	James Russell Austin.
J. D. Monro.	Miss G. T. Finlayson.
Miss Hislop.	H. Moncrieff Steele, C.A.
Miss F. F. Falconer.	William Grant, M.B., C.M.
S. M. Murray (Editor, <i>Educational News</i>).	Andrew Bell, M.A.
Miss Nisbet.	Frank Spence, M.A., B.Sc., F.R.S.E.
Thomas W. Paterson.	Robert Black.
Simon B. Henderson.	William Wallace Anderson, M.A.
	William Davidson, F.F.A.

DIPLOMA OF FELLOWSHIP.

The Council conferred the Honorary Diploma of Fellowship on J. Scott Keltie, LL.D., Secretary of the Royal Geographical Society, and on Colonel J. de Schokalsky, President of the Physical Section of the Imperial Geographical Society of Russia.

They also conferred the Ordinary Diploma of Fellowship on James W. Lowber, Ph.D., D.Sc., F.R.G.S., F.R.A.S., ex-President and ex-Chancellor Austin, Texas, U.S.A., and William Gray Leiper, C.E., Assistant Surveyor to the London, Brighton, and South Coast Railway, Members of the Society, subject to the prescribed conditions being complied with.

THE ANNUAL BUSINESS MEETING.

The Annual Business Meeting was held on 12th November in the Society's Hall, Professor James Geikie, D.C.L., LL.D., F.R.S., President of the Society, in the Chair.

Major Forbes, the Secretary, read the Report of Council, which stated that 105 new members had been added, 45 had died, and 139 had resigned, making the membership at October 31st 1873 compared with 1852 a year ago. Of this number 1204 are on the Edinburgh list, 373 on the Glasgow list, and 133 and 96 on the Dundee and Aberdeen

lists respectively. Forty-four reside abroad and 103 in England. Of the total 270 are life members. There are 22 teacher associates. During the past session 227 books, 57 pamphlets, 104 reports, 13 atlases, 305 map-sheets and charts had been added to the library. The number of volumes borrowed by members was 1612, and the library was, as usual, much consulted by non-members in search of geographical information. The Council desires to record its thanks to foreign and Colonial Governments for the official publications they have presented to the library; to the Treasury, for the revised Ordnance Survey maps of Scotland, both in outline and colour, as each of the revisions now in progress is published; and also to the undermentioned private donors of books and maps, viz.:—Prince of Monaco, Ralph Richardson, Julius Girard, Colonel P. Durham Trotter, C. G. Cash. Members of the Glasgow centre will again have the advantage of the arrangement made with the Royal Philosophical Society of Glasgow, whereby that society's very complete library at 207 Bath Street, Glasgow, will be available to them without extra payment. The private room at 207 Bath Street, presently rented, has been retained for the exclusive use of members of the Glasgow centre.

Mr. James Currie, Honorary Treasurer, submitted the financial statement, which showed a revenue of £1875, and an expenditure amounting to £1893. Last year, he said, there was a deficiency of about £255, and this year, although that sum had not been entirely wiped out, it had been reduced to £18.

The Chairman moved the adoption of the Report. He thought it was highly satisfactory, and said a good deal for the management of the Society that they had been able to clear off such a large deficit without diminishing the attractiveness of the Society. He pleaded for some recognition and endowment of the Society by the Government. They spent a good deal of money solely on geographical education, and when the Government was now recognising the necessity for more geographical teaching in schools and colleges, he thought the Society had some claim on them.

Dr. Dods seconded, and the Report was adopted.

Professor James Geikie was re-appointed President, and the following members of Council who retire by rotation were re-elected:—D. F. Lowe, M.A., LL.D., George Smith, LL.D., C.I.E., W. B. Blaikie, F.R.S.E., Captain D. Livingstone Bruce, Colonel T. Cadell, V.C., C.B., Colonel Wardlaw Ramsay, John Kerr, LL.D. (Edinburgh); R. S. Allan, A. Crosbie Turner (Glasgow); I. Julius Weinberg, J.P., F.R.S.G.S., A. B. Gilroy, and Sir George W. Baxter, LL.D. (Dundee).

The following members of the Society were elected to fill vacancies on the Council:—The Right Hon. James P. Gibson, Lord Provost of Edinburgh, Professors Alexander Darroch, M.A., and T. Hudson Beare, B.A., B.Sc., M.I.C.E., of the University of Edinburgh, W. S. Bruce, LL.D., Scottish Oceanographical Museum (Edinburgh); The Hon. Sir William Bilsland, Lord Provost of Glasgow (Glasgow); R. B. Don, Robert Sinclair, M.D. (Dundee); Professor J. A. Thomson, M.A., and William Smith (Aberdeen).

The Chairmen of the Glasgow and Dundee centres were re-elected. Mr. William Smith was elected Chairman of the Aberdeen centre in room of Professor J. Arthur Thomson, M.A., who has resigned.

LECTURES IN DECEMBER.

Mrs. Fanny Bullock Workman, F.R.S.G.S., Officier de l'Instruction Publique de France, will lecture before the Aberdeen, Dundee, Edinburgh, and Glasgow centres, on the 10th, 11th, 12th, and 13th respectively. The subject of her address will be "Exploration and Climbing in the Nun Kun Massif, Himalaya." The Lecture will be illustrated with lantern views. The Christmas Lecture will be delivered by Mr. William C. Smith, K.C., in Glasgow on the 21st, Dundee 23rd, Edinburgh 26th, and Aberdeen 27th, on the "Mountains of Scotland," illustrated with views.

OBITUARY.

Admiral Sir FRANCIS LEOPOLD MCCLINTOCK.

WE regret to record the death of Sir Leopold McClintock, which took place at his residence on Sunday, November 17.

In our August issue, p. 434, we noted the fact that the Council of the Royal Geographical Society recently addressed a letter to the deceased Admiral on the occasion of the fiftieth anniversary of the sailing of the *Fox*. This letter recapitulates in large part the claims of Sir Leopold to the gratitude and respect of all geographers.

Born in 1819, Sir Leopold McClintock received his training in Arctic work in the *Enterprise*, under Sir James Clark Ross (1848-9), and in the *Assistance*, under Sir Erasmus Ommaney (1850-1). During the latter cruise he made a great sledge journey of 760 miles in 60 days. In the spring of 1852 he was put in command of the *Intrepid*, one of a fleet of five vessels sent in search of Franklin. The *Intrepid*, which had to be abandoned during the expedition, wintered off Melville Island, and McClintock surveyed and charted the west coast of Prince Patrick Island and the vicinity, accomplishing a sledge journey of 1210 geographical miles in 105 days. Three years after his return he was put in charge of the *Fox*, the yacht fitted out by Lady Franklin to search for her husband. From this expedition he returned in 1859 with indubitable evidence of the fate of Franklin and his companions. The results of this expedition were detailed in *The Voyage of the Fox in the Arctic Seas*. Admiral McClintock subsequently rose high in his profession, and received from various learned societies and universities gratifying evidence of the appreciation in which his countrymen held his services.

As the letter to which we have drawn attention above points out, Admiral McClintock was specially noteworthy in connection with the improvements which he effected in Arctic sledge travelling, of which he was indeed the pioneer.

GEOGRAPHICAL NOTES.

EUROPE.

Report on the Progress of the Ordnance Survey.—We have received the usual *Annual Report*, bringing the account of the progress of this Survey up to March 31, 1907. As regards the Cadastral Survey of Scotland on the 1:2500 scale, we note that the second general revision is now in progress in the Counties of Ayr, Kirkcudbright, and Wigtown. The total area of the revised maps published is 11,835 square miles, of which 693 square miles have been published during the year. Details in regard to this as well as the other revisions will be found in the list of New Maps published in this *Magazine* every second month. As regards the maps on the scale of six inches to a mile, it is noted that the revised maps are, for the cultivated districts, being reduced from the revised maps on the 1:2500 scale, and are produced by heliozincography, except in the south and west of Inverness-shire, in Deeside, in the west of Ross-shire, in Sutherland and Caithness, where the alterations have generally been so small that the revision is being carried out on the copper plates. In uncultivated districts the revision is made direct on the original 6-inch maps. Publication follows as soon as possible that of the 25-inch maps. The total revised area published on this scale is 25,566 square miles, of which 1590 square miles have appeared during the year.

Of the maps on the scale of one inch to a mile, 2587 square miles were revised and drawn last year, and 3442 square miles were engraved. The coloured 1-inch map is being prepared and published as the revised 1-inch sheets and the separate hill-plates become available. The preparation of separate hill-plates has been continued, and last year 7623 square miles were engraved, and 3938 square miles published. The drawing of the map on the scale of two miles to the inch has been temporarily suspended, but it is hoped that some sheets will be published during the forthcoming year. In the town surveys the resurvey and revision of Aberdeen, Dundee, and Ayr on the 1:500 scale has been completed at the expense of the corporations.

During the financial year under report the total sales of Ordnance Survey maps amounted to £31,341 gross and £22,852 net, showing a net increase over those of the preceding year of £952. As regards the arrangements for distribution a change has been made in that the previously existing agencies have been confined to the sale of the 6-inch and larger scale maps, while the sale of the small scale maps to the trade has been placed in the hands of a wholesale agent, Mr. T. Fisher Unwin, who also supplies the agents with these maps. This arrangement has now been extended to Scotland. The Edinburgh agents, Messrs. Menzies and Co., having resigned their agency, they have been replaced by Messrs. W. and A. K. Johnston in Edinburgh, and Messrs. J. Smith and Son in Glasgow.

ASIA.

Bennett Island.—It will be remembered that the expedition commanded by M. Koltschak, which went in search of Baron Toll's party, found at Bennett Island some relics of that ill-fated party, including a note-book, some geological specimens, and abandoned instruments. In the *Proceedings* of the Russian Geographical Society M. Koltschak publishes some account of the island, based partly upon the exploration conducted by the relief party, and partly on Baron Toll's notes. The article, which appears in Russian, is abstracted in *La Géographie* for July 15, from which we extract the following:—Bennett Island has the shape of a rectangular triangle, with an area of 200 square kilometres. The south and east sides have each a length of 15 kilometres, and the north-west side one of 23 kilometres. The island rises fairly rapidly to a height of 300 metres, and has two considerable elevations—Mount Long, the highest point, rising to 500 metres, and occupying the south-western angle, and Mount Toll, occupying the whole of the north and north-east of the island. The latter forms an abrupt crest, cut by deep valleys which carry away the torrents arising from the snow and ice fields. The openings of these torrents are the only places where it is possible to effect a landing, for elsewhere the cliffs fall sheer to the sea. The narrow beaches are covered with ice, through which the streams wear a passage. On the southern coastline structures having the appearance of glaciers descend from the *névé* of Mount Toll, but they show no sign of movement. The most westerly has a width of 1 kilometre, and ends at the sea in an ice-cliff varying in height from 3 to 15 metres. The other ice-stream is smaller; neither shows any signs of morainic deposits. The valley which descends from the hill near Cape Emma, at the south-western angle of the island, seems formerly to have contained a glacier. The eastern border of the island forms a series of hills of 150 metres in height, which are covered with a meagre tundra vegetation. The island seems to consist of Cambrian rocks, overlaid by sheets of basalt. In the valleys the bones of mammoths and other Quaternary mammals occur, but living game-animals are rare.

Upper Burma.—We have received from Dr. Hans Wehrli a reprint of a paper on the economic geography and the distribution of the population in Upper Burma and the northern Shan States, which originally appeared in the *Wissenschaftliche Beilage z. Jahresbericht d. Geogr. Ethnogr. Gesellschaft*. (Zürich, 1905-6). The paper is illustrated with maps and plates, and gives a comprehensive account of the regions mentioned.

Upper Burma is situated between 19° and 27° N. lat., so that the region of most economic importance, the great depression, has a tropical climate. Like India, Burma is under the influence of the summer monsoon. The year consists of a dry and relatively cold period, from November or December to February, a hot period from March to the

middle of May, and finally the rainy season from May to October. In the plain the mean temperature varies from 26° to 27° C., and while on the coast and in the delta the difference between the months of extreme temperature is only 4° to 5° , in Upper Burma it varies from 11° to 12° . The rainfall of Burma is very unequally distributed. The coastal districts of Tenasserim and Arakan have an annual fall exceeding 4000 mm., the delta region a mean annual total of 2000 to 3000 mm.; in the dry plains of Upper Burma the total fall is only 400 to 1000 mm., while the rainy region of the north has a total exceeding 1500 mm. The causation of this distribution is obvious. The rainiest region is on the western slope of the coastal chain, where the direct influence of the monsoon is felt. Upper Burma, on the other hand, is protected by the same mountain chain from the influence of the rain-bearing wind. In this dry depression the amount of rain varies considerably, and thus disastrous droughts often arise. The sources of the Irawadi, the only economically important stream in Upper Burma, are placed in the humid territory in the north-west, a fact which explains its great volume of water. The Salwin, on the other hand, rises in a region sheltered from the rain-bearing winds by the chain of Kachin, and has therefore a smaller volume in spite of its longer course.

In 1901 the total population of Burma was 10,500,000, of which Upper Burma included 3,600,000. Of the total population of Upper Burma 3,243,000 were Burmas, that is about nine-tenths of the total population of the province. The remainder are made up of Shans, Chingpaws (Kachin), Chins, Palaung, Chinese and Hindoos, with a numerically insignificant European element. The characteristics of the different native races are discussed by the author in detail. For the most part the population is occupied in agriculture and the pastoral industries. While in the delta and on the coastal region of Lower Burma rice is naturally the chief cultivated plant, in the more varied conditions of Upper Burma a greater variety of plants occur. Among these may be mentioned such cereals as millet, maize, wheat, sesame, with some rice, cotton, sugar-cane, sugar-palm, indigo, tobacco, tea. The forests contain such valuable trees as teak, rubber, *Acacia catechu*, etc. The flocks consist of zebu and buffaloes, bred as draught animals or beasts of burden, and not for their flesh or milk.

As regards the population, the most widely distributed form of settlement is the village, which usually contains less than 200 inhabitants. The houses are built of wood and are placed on piles. The mean density of population in Upper Burma and in the Shan States is only seventeen per square kilometre, but the distribution is very irregular. In consequence of political changes, fresh adjustments are now taking place, but formerly the rainy region had a low density and the dry regions a high. The reasons for this curious distribution are complex, but among them may be noticed the fact that the rainy regions of the north were favourable to extensive cultivation, which does not demand a dense population, while regions of a naturally low rainfall where irrigation is practised must be regions of intensive cultivation and denser population.

AFRICA.

The Frontier of Liberia.—In connection with our note on this



subject in our last issue, p. 601, we now publish a sketch-map showing provisionally the new frontier line.

POLAR.

Expedition to the Arctic.—Dr. Frederick A. Cook, who was believed to be arranging for an expedition to the Antarctic region (cf. p. 384), suddenly changed his plans, and has started for the North Pole. A message from Etah, Greenland, was received from him in New York during October, according to which he intends wintering in Greenland 30 miles to the north of Peary's last winter quarters, with the object of making an attempt on the Pole. He proposes to go *via* Buchanan Bay and Ellesmere Land and northward through Nansen Strait over the Polar Sea. Meantime Commander Peary is delaying his departure till next year.

The Anglo-American Polar Expedition.—In the *Bulletin* of the American Geographical Society for October, and in the *Geographical Journal* for November, illustrated accounts are given of the Mikkelsen-Leffingwell Expedition, which amplify the previous brief notices available (cf. p. 548). In regard first to the loss of the ship, the fuller account shows that it sprung a leak on January 27. In spite of constant work at the pumps the water gained, and on April 3 it was decided to abandon the vessel. A few days later the crew moved ashore, and in May, as it had become evident that repair of the damage was impossible, the ship was broken up for building material. The whole of the stores were taken on shore without loss.

On March 3 the first sledging party left the ship, but the conditions were so unfavourable that a return had to be made, and it was not until March 17 that Mr. Leffingwell, Mr. Mikkelsen, and Mr. Storkerson finally set out with a lighter equipment than on the first attempt. This party returned to the camp at Flaxman Island on May 15, so that the statement that Captain Mikkelsen himself was at Herschel Island (near the mouth of the Mackenzie river) in April must have been an error.

Owing to the bad state of the ice the sledge party was compelled to skirt the coast from Flaxman Island to about long. 149° W., where they struck seawards. After passing the edge of the land floe, about four miles from the shore, they crossed a belt of young ice, but as they proceeded northwards came more and more into a region of old floe ice, with rounded-off hummocks, the highest of which were about 30 feet above water-level. The soundings showed that the Continental Shelf extends some 43 miles from land. After reaching about 72° N. lat. the party turned, and succeeded in obtaining sufficient soundings to warrant the construction of a diagram to show the slope of the sea-bottom. Owing to the westward drift of the ice the shore was struck considerably to the west of the point at which it had been quitted in the northward march, and was then followed eastward to the camp. The westward drift of the ice occurs with easterly winds, but on the other hand there is little or no drift to the east with westerly winds. The floe ice appeared to the observers exceedingly old, and has the appearance of having been formed in a land-locked sea. An obstruction to the eastward seems necessary to explain the absence of an eastward drift with a westerly wind, but yet the shape of the Continental Shelf, as shown by the soundings, and what is already known of the conditions to the north of Herschel Island, seem to leave very little room for new land. The Eskimo reports as to land to the north of Pt. Barrow, Captain Mikkelsen is now disposed to regard as based only upon the appearance of old floe ice, and he considers that the same explanation applies to the island reported to the north and west of Harrison Bay.

Meteorological and tidal observations have been taken by the expedition, and Mr. Leffingwell has also made considerable alterations in the map of the coastal region. Captain Mikkelsen also details his plans for next season, which include soundings along the edge of the

Continental Shelf from Demarcation Point, fifty miles west of Herschel Island, to the longitude of Cross Island. He does not expect to return to the United States until the autumn of 1909.

COMMERCIAL GEOGRAPHY.

The Agricultural Development of Madagascar.—In the issue of the *Revue Générale des Sciences* for August 30, M. Leblond discusses, in a much more hopeful spirit than has hitherto been prevalent, the present condition of agriculture in Madagascar, and its future possibilities. In 1897 some samples of the soil were analysed in Paris, and a most unfavourable report was given of that of the central plateau, with the result of discouraging enterprise in that region. According to M. Leblond, this report has been accepted too readily without consideration of the local conditions influencing fertility, and the effect of the report has been increased by a current misconception in regard to the climate of the central plateau. It is always stated that the coastal region in Madagascar has a tropical climate, while that of the plateau is temperate. In point of fact, however, the plateau has two distinct seasons, one of which is hot and damp, and the other cold and dry, while the typical temperate climate has a relatively dry warm season and a cold and damp winter season. The plateau climate, therefore, in spite of the mean temperature, must be regarded as tropical in type. This point is of great importance in agriculture. Further, the limits of the seasons are not sharply defined, and as periods of drought occur in the hot season, only land which is capable of irrigation should be cultivated. It is the want of careful consideration of these and similar points which has so far led to such unhappy results in Madagascar. Under proper conditions, the author considers that there is a future for coffee, sugarcane, in certain places the cocoa-nut palm, cotton, and especially rubber, in addition to the staple rice. Madagascar is rich in rubber-producing plants, but the wild rubber is collected by the natives in a destructive manner, and the natural reserves are already in consequence largely exhausted, while as yet almost no successful plantations have been established. For agriculture on the large scale labour is necessary, and this, the author believes, must be sought in India or China, particularly in the latter country, for the Chinese readily intermarry with the native women, and settle in the country. As for cultivation on a small scale, this must be left to the natives, and M. Leblond considers that the Malagasy's capacity for profitable agriculture has been greatly underestimated. Though he will not labour in large plantations, yet when allowed to cultivate in his own way, that is, by planting valuable species in small groups, as the constantly varying conditions allow, he is exceedingly successful, rapidly adopts improved methods, and has nothing to fear from European competition. Thus the French colonists cannot compete with the natives in rice cultivation, who have also learnt to produce vegetables at a cheaper rate than their instructors. The conditions of soil and climate appear to be such that it is only the laborious native methods which are likely to be successful at present, for there is

a remarkable absence of uniformity in the surface, and the constant variations render large-scale methods difficult.

EDUCATIONAL.

AN article on "The Relation between the Geographical Position and the Productive Capacity of Land," by Dr. E. J. Russell, in the *Journal* of the Manchester Geographical Society, may be recommended to the notice of teachers as suggesting ways in which regional survey may be utilised to form an introduction to commercial geography. The paper is mostly based upon observations made in Kent and Surrey, and is illustrated by photographs taken in this region, but any district would furnish similar examples. The author considers first the relation of the topography of a land-surface to its water-supply, and shows that the possibility of any cultivation, or the particular crop which can be grown, is determined primarily by the question whether the water-supply is excessive, deficient, or adequate. While these points are determined in the first instance by topography, the nature of the soil and subsoil are of much importance in any particular case. After a brief note on the effect of wind, the author passes on to consider the complex factors which determine the temperature of any particular area, with special reference to the warming effect of the proximity of a river valley. Though in themselves these temperature differences may appear very trifling, yet their effects are of great importance to the cultivator in a region of intensive cultivation. To make this effect clear Dr. Russell gives tables of prices of early fruit and vegetables on successive days, showing that a day's difference in ripening may make very considerable difference in the prices obtainable. On the other hand, though it would seem from the tables of temperatures that a south slope is much more profitable than a northern one, yet in point of fact, with some crops, the slower, steadier growth on the northern slope may yield a harvest which, in its abundance and longer duration, more than compensates for the lower prices, due to the fact that it is put upon the market at a later stage than the crop from the southern slope. The subject is thus one of considerable educational value, in that it shows what a number of geographical deductions can be made from the mere fact of observation that a particular locality can grow earlier crops of fruit and vegetables than the surrounding districts, and also illustrates the delicacy of the adjustments which make this profitable.

Teachers will find an interesting article on the teaching of Map Projections, by M. Charles Duchesne, in the *Bulletin* de la Société Royale de Géographie d'Anvers (xxxi. 1907). The article consists of two parts, first an exposition of the theory of cartographical representations, and second a discussion on the question of the need of teaching this to school pupils, and the best methods of doing it. The first part need not concern us here, though those specially interested in the subject may find

it useful to refer to. As to the second, the author considers that something should certainly be said on the subject of map projections by all teachers of geography, but that, on the other hand, care should be taken not to say too much in regard to the mathematical theory. Every time a new map is used the teacher should recall to the class the defects of maps in general, and of that presented in particular. For this purpose it is highly important that the projection should be stated at the foot of each map—a precaution still too often neglected by cartographers and publishers. The pupils should have a general acquaintance with the more commonly used projections, and as those most commonly used are not the simplest, no attempt should be made to teach them to construct the network for themselves, for this induces a preference for the simpler types. Care should also be taken to avoid giving the impression that one projection is absolutely better than another. The relative value of each depends upon the purpose for which the map is to be used. Further, the pupil should be perfectly clear that when the region studied does not extend over more than 10° , the question as to the best cartographical method does not present itself, for the results obtained are virtually identical with all methods. They should be also taught that the number of possible methods is infinite.

In Sir George Goldie's address in our January issue, p. 10, and in the Educational Notes in the same issue, p. 49, reference is made to the fact that the new regulations for the Civil Service Examinations excluded the subject of geography. It is highly satisfactory to note that as the result of the campaign started by eminent geographers, the Civil Service Commission now announces that after next year geography, treated scientifically, will be added to the list of subjects included under the head of natural science, of which four may be taken up, in the open competitive examinations for clerkships in the Upper Division of the Civil Service.

NEW BOOKS.

EUROPE.

A Book of the Cevennes. By S. BARING-GOULD, M.A. London :
John Long, 1907. Price 6s.

We suppose there must be still a considerable number of people who would be glad to hear of a fresh place for summer quarters, where there is no golf-course and where the motor fiend has not yet penetrated, and to them we may, on the recommendation of Mr. Baring-Gould, suggest the Cevennes, a mountain tract west of the river Rhone and north of the Gulf of Lyons; and those of our readers who are acquainted with his works on Devon, Cornwall, Brittany, the Riviera, etc., will admit that Mr. Baring-Gould is an authority of experience on this particular subject. To most English readers the Cevennes recall only the well-known *Travels with a Donkey in the Cevennes*, by Robert Louis Stevenson; but, as Mr. Baring-Gould explains, the volume now before us deals with the Cevennes proper rather than the Upper Gévandau and Lozère, through which the

donkey travelled. This volume is in no sense merely a guide-book, although it fulfils the conditions of a good guide-book in many ways. It describes in detail the natural features, geography, products and resources of the region, and gives graphic descriptions of the former and present inhabitants, but the special charm of the work will be found in the many historical episodes and anecdotes which the writer has collected with much erudition and patience and has set forth in vigorous and picturesque language. Of these the chapters devoted to the gruesome story of the tavern of Peyrabeille and the sketch of the history of the strange religious movement known as the Camisards are particularly good examples. The book is well furnished with excellent illustrations, eight of which are in colour, and is heartily recommended to our readers.

Isle of Man Illustrated. Eighth edition. By REV. JOHN IMRIE.
Bournemouth : Mate and Sons, 1907. Price 1s.

This is a finely illustrated account of this popular resort, showing by its photographs that within the circumference of the island there are charms for all tastes—for those who prefer peaceful country scenes no less than for those who like crowds and movement.

Macdonald's Commercial Gazetteer of Great Britain and Ireland. Edinburgh :
Macdonald and Co., N.D. Price 3s. 6d.

This volume, of convenient form and size, contains three railway maps of England, Scotland, and Ireland respectively, and consists of the gazetteers from the firm's trade directories of the three countries. The articles are concise and to the point, and, so far as we have tested them, seem to be accurate.

The Greatness and Decline of Rome. 2 Vols. By GUGLIELMO FERRERO. Translated by Alfred E. Zimmern, M.A. London : William Heinemann, 1907.

As the author says in the preface, these volumes contain an account of the age of Cassar from the death of Sulla to the Ides of March; one of the most momentous periods of the world's history. Signor Ferrero has not been content with being a mere chronicler of events. He has endeavoured, as he indicates, to trace and deal with the often obscure conditions which led to events of importance. His purpose has been to show that history has been at all times influenced by incidents which seem trifling when they occur, but which have been the real starting-points of great social upheavals. Thus he has sought to demonstrate that the Roman world-conquest, amazing as it was, was the effect of a gradual transformation which is going on in the world in all ages, "the growth of a nationalist and industrial democracy on the ruins of a federation of agricultural aristocracies."

With the object of making this clear, the first four chapters have been dedicated to a rapid view of the history of Rome from the earliest times, showing how even the patrician was originally but a peasant not above putting his hand to the plough, and how the simplicity of the people was preserved by the stern discipline of the family life. We have a picture of the great proletarian rising under Marius, whose relationship to Cæsar gave the latter his liberal tendencies; the conservative reaction under Sulla; the crushing of Sertorius in Spain by Pompey, and the masterful way in which Cæsar, although differing in politics, joined forces with Pompey and gradually overshadowed him.

Signor Ferrero differs in many points from other historians in his interpretation of the events of this period. His views, for instance, on Cæsar's motives for the war against the Suevi and Helvetii in the first Gallic war are so divergent

from many previous opinions that he has devoted an article in the Appendix to elucidating his standpoint. He considers that Cæsar perceived that the Helvetian war was a blunder, and in order to retrieve his position he declared war against Ariovistus. In the interesting account of the death of Cæsar the author suggests that while he was a great genius, perhaps the greatest the world has ever seen, and a distinguished soldier, he was not a great statesman. In this Ferrero differs from so great an authority as Mommsen, who thought that Cæsar was what he was because "he was an incomparable statesman."

If we have a word of criticism, it is that in style the book is heavy and difficult to read, but this is partly the result of so much compression. Also we think that the use of modern current political terms is apt to mislead and to tempt the reader to imagine that there is more similarity between the periods than there really is. But Signor Ferrero has given us a book of very high merit, which has the added interest of being the exposition of the views of a cultured Italian on the ancient history of his great country.

Les Falaises de la Manche. Par JULES GIRARD, Membre de la Société de Géographie. Paris: Ernest Leroux, 1907.

After a chapter on the physiography of the shore on the French side of the English Channel the author considers the littoral abrasion. He points out that "the" current which enters the Channel reaches first Cape d'Antifer and then follows the length of the coast. This current of the incoming sea is more energetic than that of the outflowing sea; firstly, because of its impetus, and secondly, because it is generally favoured by the predominant SW. wind. Although its origin cannot be directly established, it causes an erosion of the coastline which during storms can occasion terrible ravages. . . . From the summits of the cliffs the littoral current is easily distinguishable owing to the milky tint which colours it. It carries with it the light materials dissolved by erosion, such as chalk, sandy mud, and impalpable particles of clay. This white tint is the opposite of the blue colour of the sea." M. Marchal estimated that 5,424,000 cubic metres of material are annually removed by erosion along 338 kilometres of the French coast. The English coast has suffered similarly, for during a period of thirty-three years (1867-1900) 16,745 hectares were lost. Kent has been reduced to the extent of 19 square miles. On the Suffolk coast, between the estuary of the Thames and the Wash near Dunwich, erosion between 1880 and 1902 proceeded at the rate of 0.24 metres per annum, but from 1902 to 1904 at that of 9.30 metres. These catastrophes are generally sudden, several thousands of cubic metres sometimes falling down at one time. The author discusses the nature of the rocks attacked by the sea and the method of its attack and their destruction, also the attempts successfully made to keep ports clear of accumulations of shingle, and to reclaim land from the sea for agricultural purposes. His last chapter deals with the modifications of the coastline, and, referring to that of England, he shows that the products of the erosion of the cliffs of Kent and Sussex, etc., are partially deposited in the great estuary of the Thames, which arrests the movement of the sands. The leading fact disclosed by ancient chronicles is the invasion of the Thames estuary by these sands. It is believed that, previous to the rupture of the Straits of Dover, the estuary of the Thames formed a gulf less subject to the movements of the current than after the rupture. This estuary is being constantly filled with more or less moving banks, leaving, it is true, channels facilitating navigation but subject to destruction by winter storms. The ports on the English coast which were used by the Romans are now found far inland, and Pevensey, where the army of William the Conqueror landed from nine hundred ships, is

now more than a mile from the coast. The place-name is here spelt "Prévensay," and we may remark that it was a flourishing seaport till about the fifteenth century, when coastal changes rendered its harbour unnavigable. The author makes the interesting suggestion that Dieppe "probably owes its name to the English word *deep*, applicable to its deep port in olden times." The place-name, we may add, is still pronounced "Deep" by English sailors. In 1530 a storm filled the port with shingle. M. Girard's study of the shore of the English Channel has been particularly minute on the French side, and his work is illustrated by many fine reproductions of photographs. A good general bathymetrical map of the English Channel would have been useful to locate places mentioned in the text and in order to understand more clearly the action of the marine currents.

The Shores of the Adriatic: The Italian Side. By F. HAMILTON JACKSON, R.B.A.
London: John Murray, 1906. Price 21s. net.

This is a very valuable contribution to the library of the archæologically and artistically inclined traveller, treating as it does of a comparatively little visited part of Italy. The Italian side of the Adriatic seems to have been almost neglected alike by the tourist and the student, and very few books in English have dealt with it. Our French and German neighbours, however, have not been so neglectful, and Mr. Jackson is careful to own his indebtedness to them in the compilation of his very elaborate work. This volume is a highly trustworthy guide in everything appertaining to the artistic and picturesque to be seen in the cities, towns, and villages on the Italian Adriatic coast, particularly in church architecture. It is written in quite a Ruskinian vein, and is, moreover, beautifully illustrated. We hope to see another similar volume from the same pen.

The Central Alps, Part I. (including those portions of Switzerland to the north of the Rhone and Rhine Valleys). By the late JOHN BALL. A new edition, reconstructed and revised by A. V. VALENTINE-RICHARDS. London: Longmans, Green and Co., 1907. Price 6s. 6d. net.

The above forms the first part of the second volume of the revised edition of Ball's *Alpine Guide*, and those who have used the revised edition of the first volume, published as *The Western Alps*, will cordially welcome the appearance of this part. The general plan on which the revision has been accomplished is the same as in vol. i., but the maps, taken from Ravenstein's maps of Switzerland and the Eastern Alps, are a great improvement on those in that volume.

The great charm of Mr. Ball's work is that he belonged to the period before climbing was purely a sport; in his day it was closely akin to scientific geography. He was profoundly interested in physical geography, in geology, in botany, and not only in the problem of how to get to the top of difficult mountains. The method of revision still leaves this old charm, though the members of a geographical society may be forgiven for regretting that this aspect has not been even further emphasised. For example, the visitor to the Oeschinen See would surely find his interest greatly enhanced by a note on its origin, and a reference to the very interesting paper by Herr Groll, of which an account was given here (vol. XXI., p. 268). Again, it would surely not be impossible to substitute for such an indefinite expression as "forest of pines" a note on the exact species of pine, remembering that the ordinary tourist calls the spruce fir a pine; while in view of the interest which is being taken in the study of tree-limits in the Alps, some of Mr. Richards' colleagues could surely have furnished useful notes in the case of particular peaks or areas.

But the editor may justly retort that all this is outside the sphere of a guide-book for the modern climber, and the geographer should not appear ungrateful for the excellent topographical and geological notes which have always been the feature of Mr. Ball's works, and are here retained.

Svenska Turistföreningens Årsskrift, 1906 and 1907. Stockholm : Wahlström and Widstrand.

Sweden : A Short Handbook. Stockholm : Centraltryckeriet. 1906.

Swedish Life in Town and Country. By O. G. VON HEIDENSTAM. London : George Newnes. Price 3s. 6d. net.

Resembling in general features the similar publications of the other Scandinavian kingdoms, the Year Book of the Swedish Tourist Union is specially characterised by the abundance of its excellent illustrations. In the two volumes before us these number altogether 512, of which 48 are full-page plates and of themselves give an not inadequate idea of the scenery and inhabitants of the eastern portion of the peninsula. Very different though it be from that of the Norwegian coasts, this scenery has much beauty and interest of its own, and will be appreciated by all visitors who do not constantly insist upon making invidious and unnecessary comparisons. Among numerous articles of interest in these two volumes (all unfortunately in Swedish) special reference may be made to Mr. Per Stolpe's short description of Dalsland scenery, in which the relation of the landscape to the geological structure is discussed and illustrated, and to Mr. J. E. Ljungqvist's interesting study of a Gothland Moor. One would like to see the further and fuller biological accounts which he indicates as in progress.

The *Short Handbook*, written in English, and issued by the above Association, gives a very good general account of Sweden and its resources, the last thirty pages dealing with the country from the point of view of those purposing to travel in it. A sketch-map shows the lines of railway.

The title *Swedish Life in Town and Country* expresses very accurately the scope of the third of the above books. In this little volume a great deal of information is very compendiously presented, and, so far as we have tested it, it seems very accurate. The writer evidently knows the life of Sweden from the inside ; and unpretentious as the work is, it is much more instructive than the literature which the returning summer tourist too often feels mysteriously impelled to publish.

The Russian Peasant. By HOWARD P. KENNARD, M.D. London : T. Werner Laurie, 1907. Price 6s. net.

This monograph on the Russian Peasant is from the pen of one who has had very exceptional opportunities of studying him, for Dr. Kennard tells us he has lived with him in all parts of European Russia, and has studied him in peace and in war, while now he is engaged in helping him in the more trying and fearful conditions of famine. It is not claimed that this work is exhaustive ; on the contrary, we learn that it is a precursor of a "deep comprehensive critical study of the Peasant and the Peasant question" which is promised for a future day. In the meantime, we may observe that the picture of the Russian Peasant portrayed in this book is as lurid and almost repulsive as could well be imagined, and we might add, that according to Dr. Kennard the prospects of improvement are almost non-existent. It is indeed a miserable and a shocking story, with hardly an incident or a ray of hope with which to relieve the gloom of the situation of to-day.

AFRICA.

Two Dianas in Somaliland. By AGNES HERBERT. London: John Lane.
New York: John Lane Company, 1907. Price 12s. 6d. net.

When the writer of a book of 300 pages begins with an apology or semi-apology for writing it, the reader is apt to be depressed with the feeling that there are some weary hours before him; and when the real reason is given in five words, "Simply I want to write," the feeling of depression is by no means alleviated. But we do not proceed far with a perusal of this work before we find that no apology whatsoever is needed for its appearance. It is true that of late years we have had a plethora of books on "big shoots," and it is equally true that there is a good deal of sameness in the accounts of the exploits of the writers. But this work has a peculiar interest, for it contains the narrative of a shooting expedition in Somaliland, engineered from beginning to end by two young ladies, of one of whom at any rate, *i.e.* Miss Herbert, the authoress, we may say that her literary skill is in no way inferior to her prowess as a shikari. From the start to the finish the ladies showed quite as much pluck and skill as any of their masculine predecessors, and by their deliberate abstention from unnecessary slaughter, with most tempting opportunities to add to their collection, they showed a sportsmanlike moderation and consideration which are deserving of all praise and imitation.

The "big shoot" was not always an easy matter or free from danger, and demanded from them both much fertility of resource and promptitude of decision, as well as *sang-froid* and deliberate courage. For one example of this we may refer our readers to the description of their first encounter with lions, when the authoress might easily have lost her life, and was saved only by the coolness and courage of her companion. The same courage and coolness were frequently displayed in different circumstances, as, for example, when a Somali chief refused to allow the ladies to get water at a place in the desert when their supply had become exhausted. On this occasion the chief struck at Miss Herbert with his spear, but the blow was warded off by one of her followers, and she had to tap her rifle "significantly" ere water could be obtained. Much might, and perhaps should, be said as to the skilful management of the Somali followers, the judicious handling of the desert tribes with whom they frequently came into contact, and other features and incidents of the expedition, but for these we must refer our readers to the book itself. We have, we trust, said enough to indicate that it is well worth reading, both for its literary merit and for the intrinsic interest of the narrative of an adventurous and successful sporting expedition.

Liberia. By Sir HARRY JOHNSTON, G.C.M.G., K.C.B., D.Sc. In two volumes.
London: Hutchinson and Co., 1906.

We have delayed reviewing these two beautiful and costly volumes in the hope of publishing here an extended article on the geography and resources of the Republic of Liberia, based upon Sir Harry Johnston's epoch-making work. Limitations of space have meantime prevented this, but as we hope that room for such an article may yet be found, we restrict ourselves here to merely calling the attention of those interested to this beautifully-illustrated book, which summarises what is known in regard to the Republic, and is specially rich in its accounts and descriptions of the Flora and Fauna of the region.

In Wildest Africa. By C. G. SCHILLINGS. Translated by FREDERIC WHYTE.
London: Hutchinson and Co., 1907. Price 24s. net.

Encouraged by the enthusiastic welcome which was everywhere accorded to his former work, *With Flashlight and Rifle*, Herr Schillings has now published two more volumes, in which he gives us further details of his sporting experiences in Equatorial East Africa. This supplement of his story will doubtless be received as cordially as the commencement, which we noticed at some length in the issue of this *Magazine* for August 1906. As in *With Flashlight and Rifle* there is no consecutive narrative in this work; it consists of a number of sketches and descriptions of scenes and incidents scattered over several years, and concludes with a detailed description of the apparatus with which the author was able to produce the three hundred curious and often admirable illustrations, which are the distinctive feature of the work. With regard to them he assures us that they have been reproduced from the negatives without retouching of any kind, and it is of course in this fact that their special and unique value lies. The photographs have to be carefully examined ere they can be properly appreciated, and this after an attentive perusal of his description of the apparatus and the many difficulties and dangers which are incidental to its manipulation. We need hardly say that Herr Schillings is an enthusiast in his art, although he describes his own achievements with becoming and almost exaggerated modesty. He anticipates great improvements and far greater success for those who will follow in his footsteps.

As in his former work, there is in these two volumes a vein of sadness, as Herr Schillings contemplates the gradual and indeed rapid extinction of some of the finest species of wild animals; and he again passionately pleads alike to Governments and to sportsmen that, ere it is too late, effective measures should be taken to limit the numbers of certain animals allowed to be killed, and to institute preserves or sanctuaries, where big game shall be kept alive and perpetuated for the delight and instruction of coming generations. That this can be done successfully is proved by the good results of the rules for the preservation of big game enforced by the British authorities in their African territories, and by the success of the Yellowstone Park in America. It would seem as if Herr Schillings had more particularly in his mind the unsportsmanlike wholesale slaughter of wild animals by the Boers and by some of his own countrymen, and we are glad to see that in one passage of his book he states that in German Africa the authorities have begun to adopt British methods for the preservation of big game. Undoubtedly Herr Schillings in these interesting volumes writes for sportsmen in the first instance, but his book will appeal to many others besides sportsmen. The lover of scenery will find in these pages many a beautiful and skilful word-picture descriptive of the boundless African veldt, which will charm and delight his taste. The student of natural history will find in them a treasury of interesting, novel, and instructive facts, ascertained and recorded at first hand, on the accuracy of which he may depend. The ordinary reader will learn what one feels when one is within a few yards of a lion in the dark, or when one is being charged by an enraged rhinoceros.

Things Seen in Egypt. By CLIVE HOLLAND. London: Seeley and Co., Ltd., 1908.
Price 2s. net.

In writing this little work on *Things Seen in Egypt*, Mr. Clive Holland has followed the precedent of his *Things Seen in Japan*, which we noticed in the issue of this *Magazine* for February 1907. Here we again have fifty very pretty photographs of

various objects and scenes in Egypt, and a pleasantly written letterpress, which does not pretend to be instructive, far less exhaustive. The book will be welcomed as a souvenir by those who are familiar with the wonders of Egypt, and to those who have not travelled so far it will serve as an excellent introduction to other more elaborate works which deal with the land of the Pharaohs.

Die Halbinsel des Sinäi in ihrer Bedeutung nach Erdkunde und Geschichte auf Grund eigener Forschung an Ort und Stelle dargestellt. Von Professor Dr. E. DAGOBERT SCHOENFELD. Berlin : Dietrich Reimer, 1907.

The author having concluded a journey in the Sudan in 1903, thought that it was waste of material to disband his caravan, and so decided to go on and study the Sinai Peninsula. The main object of his journey on this occasion was to follow the wanderings of the Children of Israel. He has produced a readable book which will give the reader a good idea of the people and country.

The illustrations are satisfactory.

A Woman's Trek from the Cape to Cairo. By MARY HALL. London : Methuen and Co., 1907. Price 16s. net.

As the first woman of any nationality who accomplished the entire journey from the Cape to Cairo, Miss Hall achieved a feat of which she and her sex may well be proud. Starting from Cape Town in 1904 and proceeding to Bulawayo and Salisbury, she went to Beira and sailed to Chinde, whence, sailing up the Zambesi and the Shiré, she reached Blantyre, where she says the most interesting feature is the Church of Scotland Mission founded in 1875. Then she pushed on to Lake Nyasa, over which she sailed to Karonga in eight days, passing Kota Kota with its Universities' Mission, Likoma with its Anglican Cathedral, and Livingstonia with its United Free Church of Scotland Mission. Traversing the Tanganyika Plateau she reached Fife, and then Kawimbe with its London Missionary Society's Mission. From Abercorn she crossed to Bismarckburg and entered German East Africa.

Our German friends will naturally be much interested in Miss Hall's chapters on their East African Colony. They will also be pleased with the manner in which she registers her grateful thanks to all the German officers with whom she came in contact, adding that her task would have been impossible without their thorough co-operation, kindness, and hospitality. Touching at Udjidji, where Livingstone was met by Stanley, she notes that the hut Livingstone occupied has disappeared, but that the mango tree they planted to commemorate the historic meeting still flourishes.

At Kanyinya she found a Roman Catholic Mission of White Fathers and conversed with them in German and received much kindness. These Fathers go to Central Africa for life, or until incapacitated for further service. On reaching Karinya she passed beyond the protecting arm of the German Government, regarding which, she says, "I shall always feel the deepest gratitude for the efficient aid it afforded me."

After a trip on the Uganda Railway she returned to the Victoria Nyanza and reached Entebbe, the seat of the Uganda Government, and visited the French Mission. She next proceeded to Kampala, the native capital, and was hospitably entertained at the Ladies' House of the Church Missionary Society, inspected that Society's fine hospital, and worshipped in the Anglican Cathedral. She also saw the King of Uganda, a boy of ten, playing enthusiastically at football. Her route after this was to Butiaba, on the Albert Nyanza *via* Hoima, the capital of Unyoro, with its Church Missionary Society's Mission. From Butiaba she sailed

along the Albert Nyanza till she entered the Nile and went down to Nimuli, from which (as the river is not navigable) she made her "final tramp" to Gondokoro, the most northerly station of the Uganda Protectorate and the limit of the first navigable stretch of the Nile south of Khartum. From Gondokoro she steamed down to Fashoda (now called Kodok) and reached Khartum, which she hailed with delight after months of privation and spare living.

Arriving at Cairo, she brought to a close her eventful journey, during which she had found that the Dark Continent, when administered by conscientious European officials, opened up by railways and steamers, and evangelised by Christian Missions, is not now so dark as it once was. Her volume contains sixty-four illustrations and two good maps, with a portrait of the intrepid authoress, who is shortly to give our Society the privilege of hearing from her own lips an account of one of the most remarkable journeys on record.

GENERAL.

Modern Lithology. By E. H. ADYE. Edinburgh and London: W. and A. K. Johnston, 1907. Price 10s. net.

The author of the *Twentieth Century Atlas of Micro-Petrography* has attempted to improve upon his former work by issuing a small volume bearing the above title and illustrated by coloured plates made from actual rock-sections. The idea is good, though some of the plates are not quite successful. Those of them which exhibit sections as seen in ordinary light—those, that is to say, in which comparatively low tints are used—are generally good. The Arthur's Seat basalt, the luxulyanite, the Plauen syenite, and the Wolkenburg andesite are such, and represent very faithfully the appearance of sections of these rocks. But no one has ever yet succeeded in reproducing on paper the brilliant polarisation colours of the second and third orders, and Mr. Adye's "Heidelberg Granite," his "Microcline," and others, are crude. They also represent sections many times thicker than those in ordinary use; a section in which the quartz shall show a blue of the second order must be nearly one-tenth mm. in thickness.

The text throughout is concise and accurate, but we could wish that the author had put more method into his teaching. He should not forget that the chief characteristic of *modern lithology* is systematised classification and nomenclature. The glossary is a useful feature of the book, though like the text it is not so modern as it might be. We notice, for example, the omission of many useful terms introduced by Brögger, such as *leucocratic*, *melanocratic*, *aschistic*, etc., while there is also no mention of the entire vocabulary originated by Cross and others in America.

Nevertheless the book can be recommended to students of petrology, to be studied in conjunction with sections of the rocks which it describes.

BOOKS RECEIVED.

We have received the following new books, which will be reviewed in due course:—

Murray's Handbook for Egypt and the Sudan. Edited by H. R. HALL, M.A., F.R.G.S. Eleventh edition. With 58 Maps and Plans. Pp. xiv + 613. Price 14s. London: Edward Stanford, 1907.

The Mineralogy of the Faroes, arranged Topographically. By JAMES CURRIE, M.A., F.R.S.E., President, Geological Society of Edinburgh. Pp. 68. Geological Society, Edinburgh, 1907.

A Woman's Trek from the Cape to Cairo. By MARY HALL. With 64 Illus-

trations and 2 Maps. Demy 8vo. Pp. xvi+424. Price 16s. net. London: Methuen and Co., 1907.

Across Persia. By E. CRAWSHAY WILLIAMS. With Illustrations and Maps. Demy 8vo. Pp. xii+348. Price 12s. 6d. net. London: Edward Arnold, 1907.

Across Widest Africa: An Account of the Country and People of Eastern, Central, and Western Africa, as seen during a Twelve Months' Journey from Djibuti to Cape Verde. By A. HENRY SAVAGE LANDOR. Royal 8vo. Two Volumes. Pp. Vol. i. xvi+396; Vol. ii. xii+511. Price 42s. net. London: Hurst and Blackett, 1907.

From the Niger to the Nile. By Lieut. BOYD ALEXANDER, Rifle Brigade. In Two Volumes. Large Medium. With 250 Illustrations and Maps. Pp. Vol. i. xv+358; Vol. ii. xi+395. Price 36s. London: Edward Arnold, 1907.

The Private Diary of Ananda Ranga Pillai. Dubash to Joseph François Duplex: A Record of Matters Political, Historical, Social, and Personal, from 1736 to 1761. Edited by Sir J. FREDERICK PRICE, K.C.S.I., assisted by K. RANGACHARI. Volume II. Demy 8vo. Pp. xxx+433. Price 4s. Superintendent, Government Press, 1907.

Das Mittelmeergebiet: Seine Geographische und Kulturelle Eigenart. Von ALFRED PHILIPSON. Demy 8vo. Pp. 261. Preis 7 m. Leipzig: B. G. Teubner, 1907.

Egypt and the Sudan. Handbook for Travellers. By KARL BAEDERER. 24 Maps and 76 Plans. Price 15s. Leipzig: Karl Baedeker, 1907.

The Polarity of Matter: An Introduction to Physics. By ALEX. CLARK, M.A. Crown 8vo. Pp. viii+134. Price 3s. 6d. net. London: Gall and Inglis, 1907.

The Boa Entrada Plantations, S. Thomé, Portuguese West Africa ("La Perle des Colonies Portugaises"). Translated from the original Portuguese by J. A. WYLLIE, F.R.G.S., Lieut.-Colonel Indian Army. Quarto. Pp. 63. Illustrated. Presented by Mr. Monteiro de Mendonça.

Also the following Reports, etc. :—

Administration Report of the Marine Survey of India for 1906-1907. Bombay, 1907.

Meteorology in Mysore for 1906. Fourteenth Annual Report. By JAMES COOK, M.A., F.R.S.E. Bangalore, 1907.

Report on Administration of the Meteorological Department of the Government of India in 1906-1907. Calcutta, 1907.

The Travancore State Manual. By V. N. AIYA, B.A. Three Volumes. Tri-bandrum, 1906.

Gazetteer of the Chenab Colony, 1904. Vol. xxx 1^a. Lahore, 1907.

Bengal District Gazetteers: Balasore. By L. S. S. O'MALLEY, I.C.S. Calcutta, 1907.

Baluchistan District Gazetteer. Vol. v. Quetta-Pishir District. By R. HUGHES-BULLER, I.C.S. Ajmer, 1907.

Central Provinces Gazetteer. Edited by R. V. RUSSELL, I.C.S. Three Volumes. Allahabad, 1907.

General Guide to the British Museum (Natural History): 3d. Guide to the Galleries of Mammals (B.M.): 6d. Guide to the Galleries of Reptilia and Amphibia (B.M.): 6d. A Guide to the Fossil Invertebrate Animals in the British Museum: 6d. A Guide to the Fossil Reptiles, Amphibians, and Fishes in the British Museum: 6d. List of British Seed-Plants and Ferns (Department of Botany, B.M.): 4d. London: The Trustees, British Museum, 1907.

Publishers forwarding books for review will greatly oblige by marking the price in clear figures, especially in the case of foreign books.

ROYAL SCOTTISH GEOGRAPHICAL SOCIETY.

REPORT OF COUNCIL.

TWENTY-THIRD SESSION, 1906-1907.

The Council has the honour to submit the following Report :—

ORDINARY MEMBERSHIP.

The changes which occurred during the Session in the number of members were as follows :—

Number on 1st November 1906,	.	.	.	.	1852
New members added,	.	.	.	.	105
					<hr/>
					1957
Deduct by Death,	.	.	.	.	45
„ Resignation,	.	.	.	.	139
					<hr/>
					184
					<hr/>
Number of ordinary members remaining on Roll on 31st					
October 1907,	.	.	.	.	1773

Of this number, 1024 are on the Edinburgh list, 373 are on the Glasgow list, 133 and 96 are on the Dundee and Aberdeen lists respectively. In addition to those on the lists named, 44 members reside abroad, and 103 reside in England. Of the total number of 1773 members, 270 are life members.

TEACHER ASSOCIATE MEMBERS.

Number 1st November 1906,	.	.	.	.	31
Resignations,	.	.	.	.	9
					<hr/>
					22

Eight of the Teacher Associates who resigned did so to rejoin as ordinary Members.

MEETINGS.

The Society's Anniversary Meeting was addressed by The Right Hon. Sir G. D. Taubman Goldie, P.C., K.C.M.G., F.R.S., D.C.L., LL.D., President of the Royal Geographical Society. Thirty-six ordinary meetings were held, nine of them in Edinburgh, nine in Glasgow, nine in Dundee, and nine in Aberdeen. These meetings were addressed by Sir W. Martin Conway, M.A., F.S.A., F.R.G.S., Major A. St. Hill Gibbons, F.R.G.S., Prof. J. Arthur Thomson, M.A., His Serene Highness the Prince of Monaco, Prof. Sir W. M. Ramsay, D.C.L., LL.D., Litt.D., C. G. Seligmann, M.B., Prof. George Adam Smith, M.A., D.D., LL.D., T. G. Longstaff, M.B., F.R.G.S., H. M. Cadell, B.Sc., Prof. D'Arcy W. Thompson, C.B., M.A., Marion I. Newbigin, D.Sc. (Lond.), Charles J. Wilson, F.R.S.G.S., R. N. Rudmose Brown, B.Sc.

MEDALS AWARDED.

The Livingstone Gold Medal of the Society for 1906 was awarded to Sir George D. Taubman Goldie, the "Founder of Nigeria," in recognition of his services in extending civilisation and commerce in Africa.

The Society's Gold Medal for 1906 was awarded to H.S.H. the Prince of Monaco for his important researches in Oceanography. The Society's Silver Medal for 1906 was awarded to Sir W. M. Ramsay, in recognition of his valuable work in connection with the Ancient Geography of Asia Minor.

THE SOCIETY'S MAGAZINE.

The *Scottish Geographical Magazine* has, as usual, been published throughout the past session monthly, with maps and illustrations.

The Council is glad to acknowledge its obligation to the contributors of articles, and to the following gentlemen who have rendered valuable assistance to the editors:—Hon. John Abercromby; J. G. Bartholomew; W. S. Bruce; H. M. Cadell; S. H. F. Capenny; Dr. A. S. Cumming; James Currie; L. Geddie; Dr. R. N. Felkin; H. B. Finlay; Professor James Geikie; Dr. John Gunn; John Laidlaw; Rev. Robert Mackenzie; R. C. Mossman; James Murray; Dr. J. Harvie Pirie; J. R. Reid; Ralph Richardson; Kenneth Sanderson; E. H. Shackelton; Dr. George Smith; C. W. A. Tait; W. A. Taylor; W. B. Wilson.

LIBRARY AND MAP DEPARTMENT.

During the past session 227 books, 57 pamphlets, 104 reports, 13 atlases, 305 map-sheets and charts have been added to the Library. The number of volumes borrowed by members was 1612, and the Library was, as usual, much consulted by non-members in search of geographical information.

The Council desires to record its thanks to foreign and colonial governments for the official publications they have presented to the Library; to the Treasury, for the revised Ordnance Survey Maps of Scotland, both in outline and colour, as each of the revisions now in progress is published; and also to the undermentioned private donors of books and maps, viz.:—Prince of Monaco; Ralph Richardson; Julius Girard; Col. P. Durham Trotter; C. G. Cash.

GLASGOW CENTRE.

Members of the Glasgow Centre will again have the advantage of the arrangement made with the Royal Philosophical Society of Glasgow, whereby that Society's very complete Library at 207 Bath Street, Glasgow, will be available to them without extra payment.

Members desirous of exercising this privilege must exhibit their Membership Cards for the current Session to the Librarian at 207 Bath Street, in order that their names may be registered, and they must conform generally to such regulations as may from time to time be laid down by the Royal Philosophical Society.

The private room at 207 Bath Street, presently rented, has been retained for the exclusive use of Members of the Glasgow Centre.

GLASGOW, DUNDEE, AND ABERDEEN CENTRES.

The Council has again the pleasure to acknowledge the services rendered by the honorary officials of the Glasgow, Dundee, and Aberdeen Centres for their continued successful conduct of the business of the Society.

FINANCE.

The Council begs to submit the Annual Financial Statement.

ABSTRACT OF THE ACCOUNTS OF THE ROYAL SCOTTISH GEOGRAPHICAL SOCIETY

From 31st October 1906 to 31st October 1907.

FUNDS AT THE CLOSE OF LAST ACCOUNT:—

£1000 Glasgow and South-Western Railway Company 4 per cent. Funded debt, at cost price, as at 29th May 1886,	£1102 19 9
£533, 6s. 8d. North British Railway Company 3 per cent. Consolidated Lien Stock, at cost price, as at 30th December 1890,	496 2 0
£200 Great Central Railway 4½ per cent. Debenture Stock, at cost price, as at 31st December 1888,	312 2 9
£240 North British Railway Company 4 per cent. Consolidated Preference Stock, at cost price, as at 11th December 1902,	306 8 9
BALANCES due by Bank of Scotland—	£2217 13 3
1. On Account Current,	£13 17 5
2. On Deposit Receipt,	4 19 5
3. Do., (Glasgow Equipment Fund):	55 17 6

BALANCE due by Secretary,	74 14 4
BALANCE due for Advertisements (since paid),	11 18 2
	116 2 10
BALANCE due to Livingstone Fund,	£22420 8 7
	28 1 2

SUBSCRIPTIONS from Ordinary Members,	£2392 7 5
Do. do. Life Members,	£1674 15 0
Do. do. Associate Members,	80 0 0
Fees received for Society's Diploma,	16 5 6
DIVIDENDS and INTEREST,	22 1 0
	82 7 0
	1875 8 6

MAGAZINE— Expenses of Publication, etc., for Nos. 11 and 12 of Vol. XXII., and Nos. 1 to 10 of Vol. XXIII. :—	
Printing and other charges,	£545 4 11
Illustrations, . £69 7 6; Maps, . £44 4 0	113 11 6
Less—	
Magazines sold,	£658 16 5
Advertising Receipts, less Payments,	132 0 10
	£526 15 7

GENERAL PRINTING,	£526 15 7
Books and other furnishings for Library,	94 12 2
RENT OF HALLS, and other expenses of Lectures,	21 4 3
Less Lecture Tickets sold,	£584 16 4
	105 0 6

GLASGOW BRANCH, Rent of Hall	479 15 10
RENT OF COUNCIL ROOM, Taxes, Gas, Repairs, Insurance, etc.,	20 0 0
SALARIES,	131 7 4
MISCELLANEOUS, including Stationery, General Expenses, Postages,	498 16 0
MEDALS,	102 13 4
	18 13 6
	£1893 18 0

FUNDS AT CLOSE OF THIS ACCOUNT:—

£1000 Glasgow and South-Western Railway Company 4 per cent. Funded Debt, at cost price, as at 29th May 1886,	£1102 19 9
£533, 6s. 8d. North British Railway Company 3 per cent. Consolidated Lien Stock, at cost price, as at 30th December 1890,	496 2 0
£200 Great Central Railway 4½ per cent. Debenture Stock, at cost price, as at 31st December 1888,	312 2 9
£240 North British Railway Company 4 per cent. Consolidated Preference Stock, at cost price, as at 11th December 1902,	306 8 9
	£2217 13 3

BALANCES due by the Bank of Scotland:—

1. On Account Current,	£153 7 7
2. On Deposit Receipt,	4 19 5
3. On do. do. (Glasgow Equipment Fund),	57 9 7

BALANCE due by Secretary, 9s. 7d., and Glasgow Secretary, £1, 12s.,	215 16 7
PAYMENTS in connection with "Chair of Geography" (recoverable),	2 1 7
	6 12 6

Less—	
BALANCE due to Livingstone Fund,	£2442 3 11
ACCOUNT outstanding,	£27 10 6
	40 15 6
	68 6 0
	2373 17 11

£4267 15 11

Edinburgh, 8th November 1907.—We have examined the Accounts of the Royal Scottish Geographical Society for the year ending 31st October 1907, of which the above is an Abstract, and compared them with the Vouchers and Instructions thereof, and find the same correct and sufficiently vouched. MACANDREW & BLAIR, C. A.

LIVINGSTONE MEDAL FUND.

FUNDS AT CLOSE OF LAST ACCOUNT :—

£770 North British Railway Company 4 per cent. Preference Stock No. 1, at cost price,	£999 11 6
Balance due by General Fund,	28 1 2
	<hr/>
	£1027 12 8

Paid Messrs. Alex. Kirkwood and Son for Medal,	£29 16 0
Funds at close of this Account—	
£770 North British Railway Company 4 per cent. Preference Stock No. 1, at cost price,	£999 11 6
Balance due by General Fund,	27 10 6
	<hr/>
	1027 2 0

Income received—

Dividend on £770 North British Railway Company 4 per cent. Preference Stock No. 1—	
For half-year to 31st January 1907, £15, 8s., less tax, 15s. 4d.,	£14 12 8
For half-year to 31st July 1907, £15, 8s., less tax, 15s. 4d.,	14 12 8
	<hr/>
	29 5 4
	<hr/>
	£1056 18 0

£1056 18 0

Edinburgh, 8th November 1907.—Examined and found correct.—MACANDREW & BLAIR, C.A.

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Printed by T. and A. CONSTABLE, Printers to His Majesty
at the Edinburgh University Press

THE SCOTTISH GEOGRAPHICAL MAGAZINE



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PROFESSOR JAMES GEIKIE, D.C.L., LL.D., F.R.S., *Honorary Editor*.
MARION I. NEWBIGIN, D.Sc., *Editor*.

EDINBURGH:

PUBLISHED BY THE ROYAL SCOTTISH GEOGRAPHICAL SOCIETY, QUEEN ST.

Printed by T. AND A. CONSTABLE, at the University Press.

Agents—EDINBURGH: Douglas & Foulis. GLASGOW: Jas. MacLehose & Sons.

LONDON: Edward Stanford, 12, 13 and 14 Long Acre, W.C.

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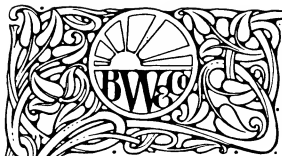
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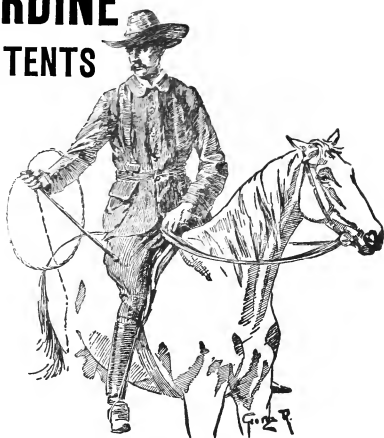
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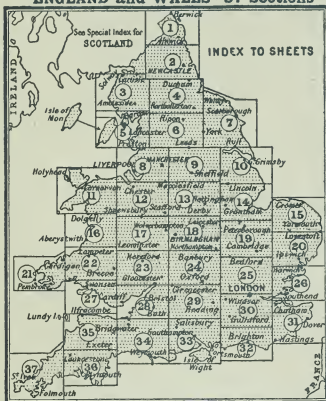
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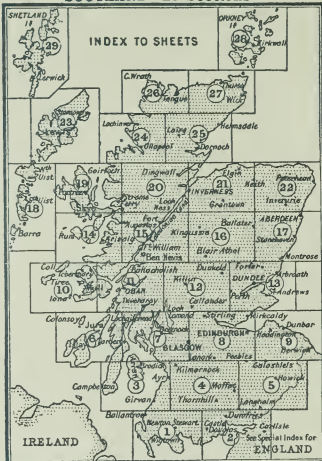
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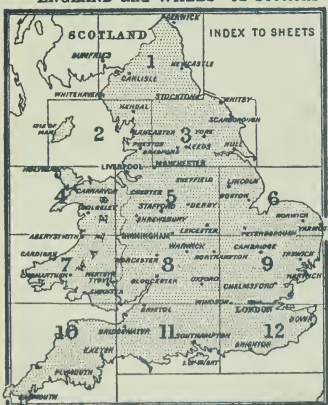
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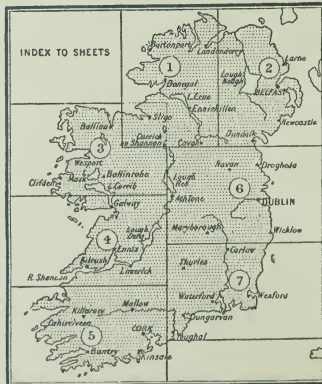
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